MSK / 2025

Orthopedic Hardware

Nomenclature and Complications for the Radiologist

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RAF
Radiology Associates of Florida, P.A.
a radiology partners practice

WHY LEARN NOMENCLATURE

"Know a thing's true name, and gain power over it"

WHY LEARN NOMENCLATURE

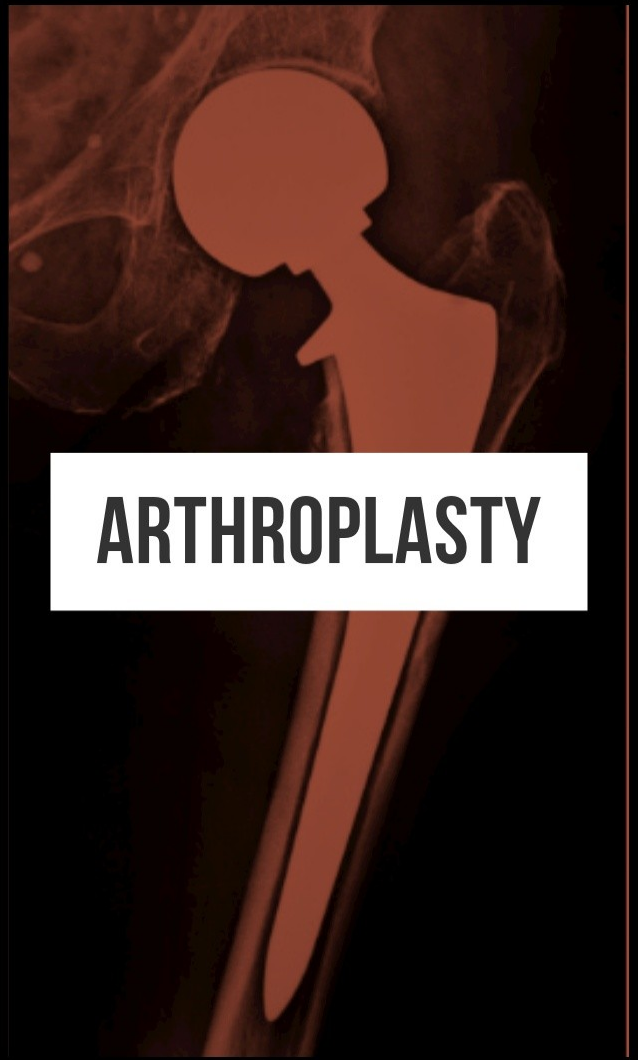
WHY LEARN TO DESCRIBE HARDWARE?

The name often implies the function

Classifying hardware sharpens our recognition of complications

Improves the relevance and credibility of our reports

FIXATION


ARTHROPLASTY

MISCELLANEOUS

Fixation / principles

eduction of fracture fragments to anatomic alignm

ixation to provide rigid or flexible stability

lood supply preservation

lobilization as soon as safely possible

Rigid Fixation

Flexible Fixation

Rigid Fixation

No motion of fragments is permissible

Flexible Fixation

Physiologic motion is permissible

Rigid Fixation

No motion of fragments is permissible

Fragments must be tightly compressed

Flexible Fixation

Physiologic motion is permissible

Fragments are stabilized but not compressed

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No callus formation

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Callus formation

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Fragments must be tightly compressed

No callus formation

Appropriate for articular fractures

Flexible Fixation

Physiologic motion is permissible

Fragments are stabilized but not compressed

Callus formation

Appropriate for diaphyseal fractures

Rigid Fixation

No motion of fragments is permissible

Fragments must be tightly compressed

No callus formation

Appropriate for articular fractures

Compression plates

Tension wires

Lag screws

Flexible Fixation

Physiologic motion is permissible

Fragments are stabilized but not compressed

Callus formation

Appropriate for diaphyseal fractures

Intramedullary nails

Bridge plates

External fixator

Fixation / screws

Fixation / screws

Provide fixation alone or
with other hardware

Fixation / screws

Provide fixation alone or with other hardware

Anchor in cortical bone or medullary bone

Fixation / screws

Provide fixation alone or with other hardware

Anchor in cortical bone or medullary bone

Screws that provide compression are called “lag screws”

Fixation / cortical screws

Designed to anchor in cortical bone

Often fully threaded

Fine thread pitch for highest holding power

Fixation / cortical screws

Cortical screws optimally traverse both cortices

Often used to fix plate to bone

Fixation / cancellous screws

Designed to anchor in medullary bone

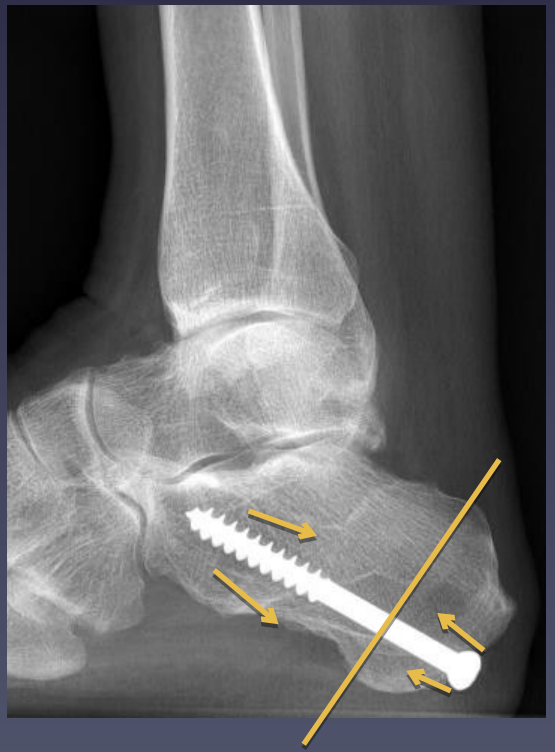
Often partially threaded
Wider thread pitch

Fixation / cancellous screws

Fixation / cancellous screws

Calcaneal cancellous screw

This is being used as a lag screw for interfragmentary compression



Fixation / cannulated screws

Hollow screws placed coaxially over a wire

Fixation / cannulated screws

Parallel cannulated screws
for femoral neck fixation

Fixation / screws

Fixation / screws

Acutrak headless cancellous lag screw

Fixation / screws

Acutrak headless cancellous lag screw

Lag effect due to variable thread pitch

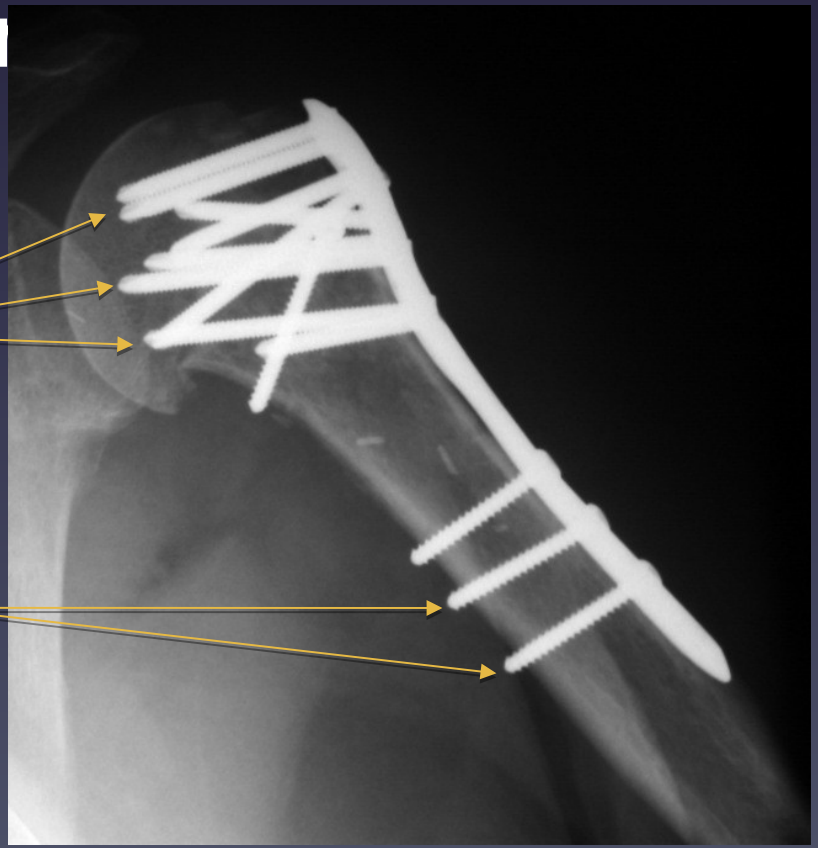
Fixation / locking screws

Fixation / locking screws

Finest thread pitch of all screws
Screw head is threaded to lock into plates

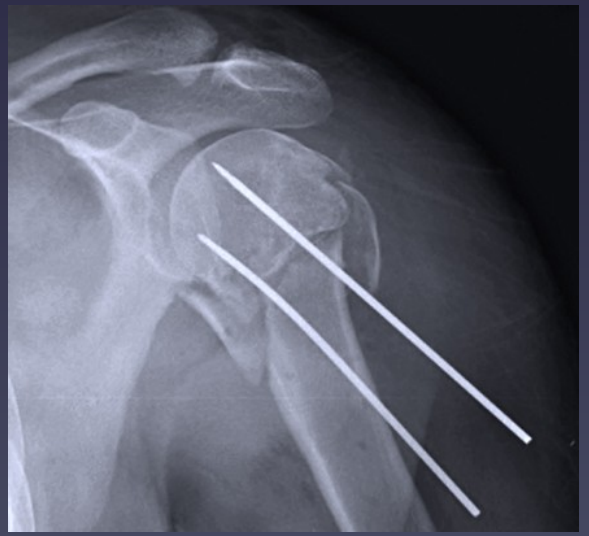
Fixation / locking scr

Finest thread pitch of all screws
Screw head is threaded to lock into plates



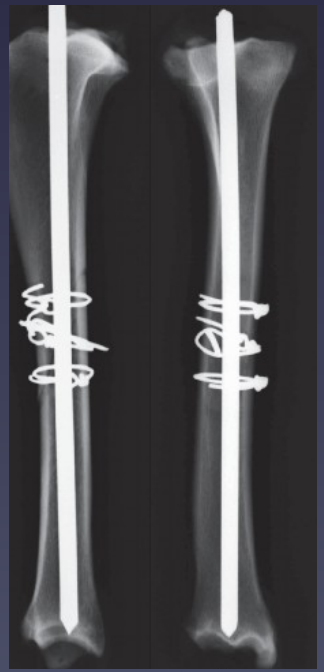
Fixation / wires

Kirschner wires
“K-wires”

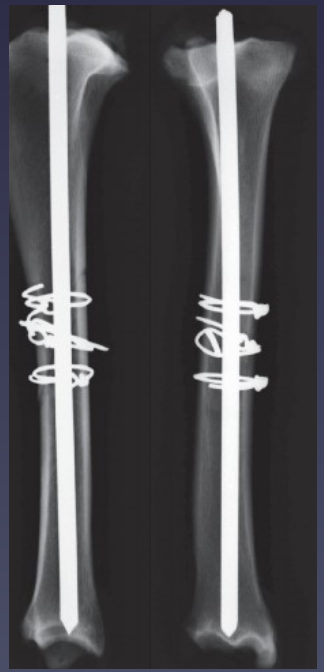


Percutaneous pins

Fixation / wires

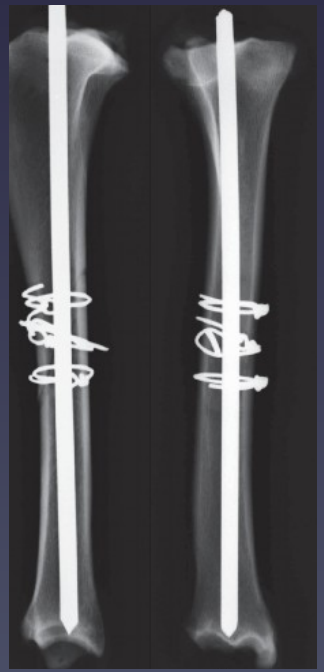


Fixation / wires



Cerclage wires
Stabilize fragments
Tension achieved by twisting wire

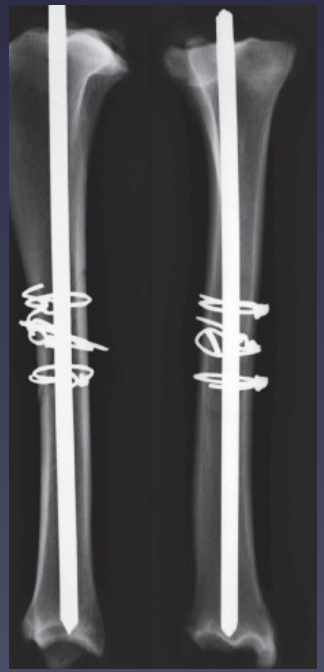
Fixation / wires



Cerclage wires
Stabilize fragments
Tension achieved by twisting wire

Tension wires
Turn a distractive force into a compressive force

Fixation / wires

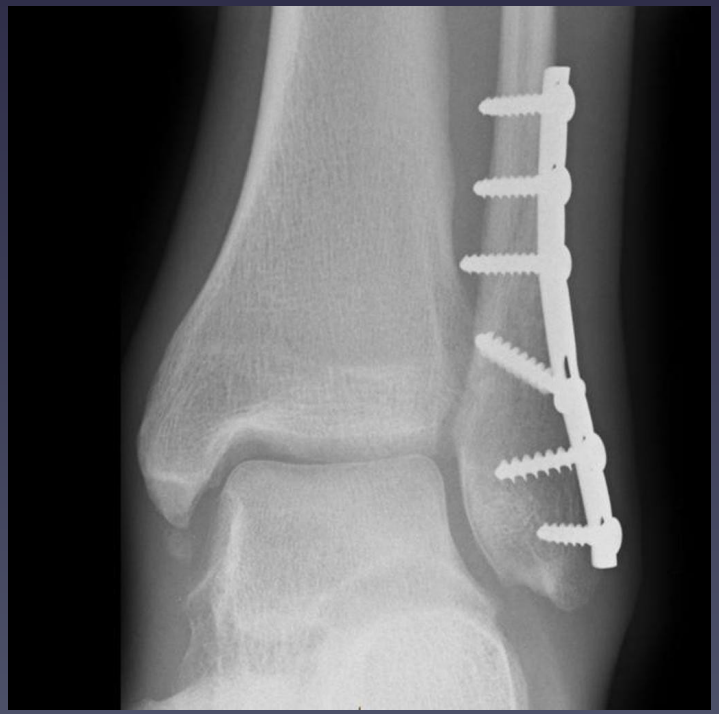


Cerclage wires
Stabilize fragments
Tension achieved by twisting wire

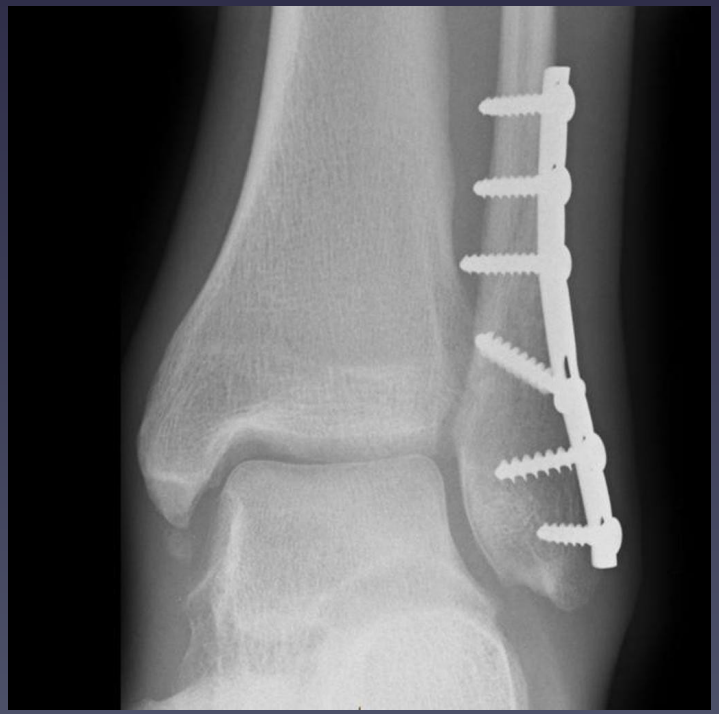
Tension wires
Turn a distractive force into a compressive force

Radiolucent FiberWire spans two EndoButtons for syndesmotic fixation

Fixation / plates / cortical

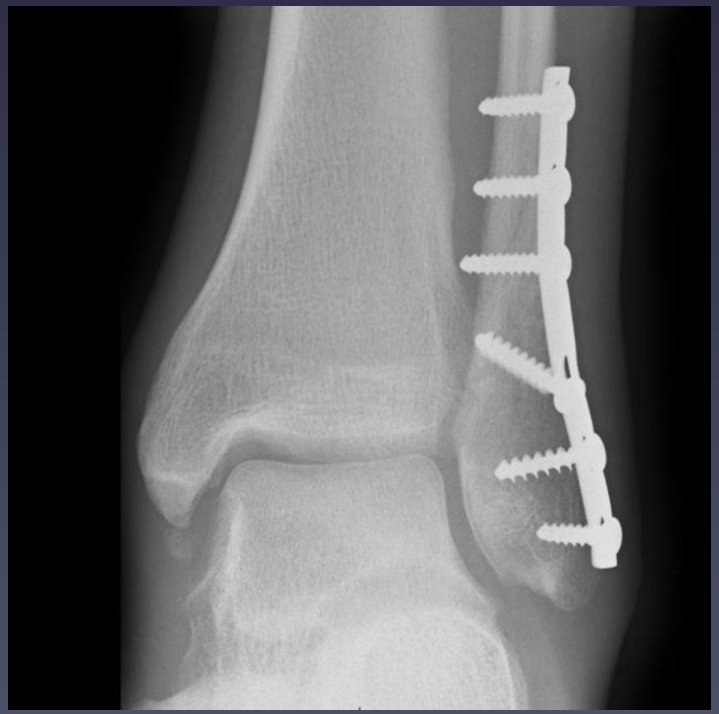


Fixation / plates / cortical



Plates provide rigid fixation

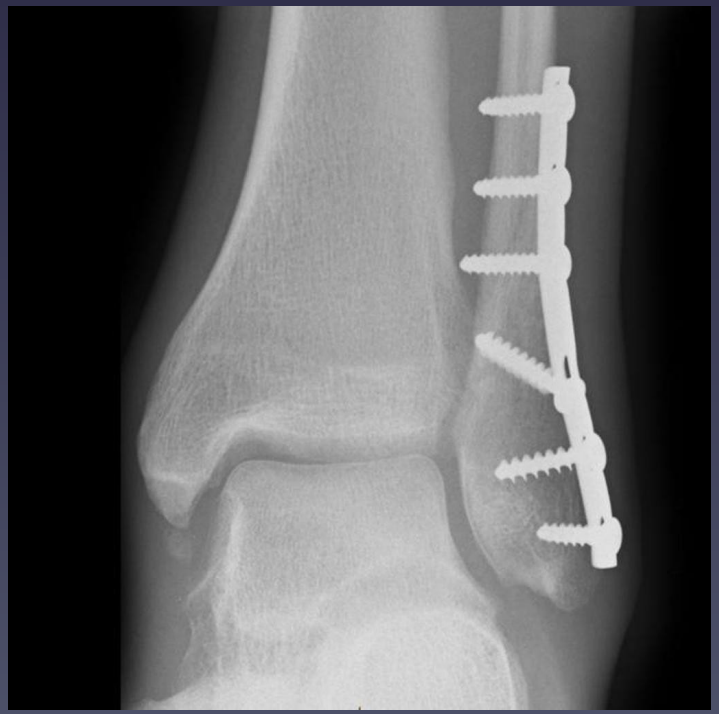
Fixation / plates / cortical



Plates provide rigid fixation

Cortical plates are closely pressed to bone by screws

Fixation / plates / cortical



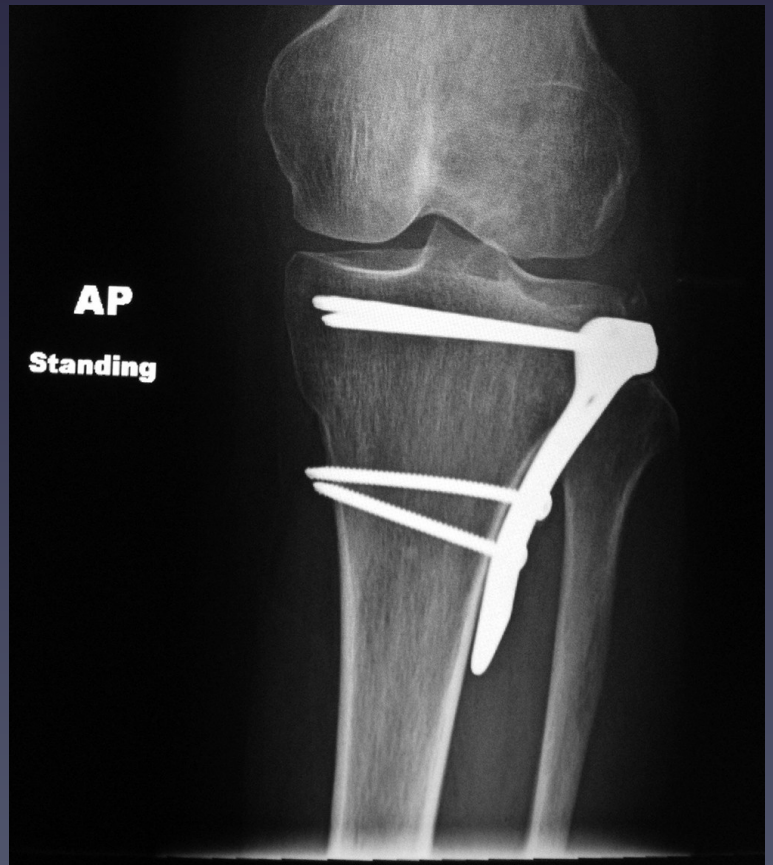
Plates provide rigid fixation

Cortical plates are closely pressed to bone by screws

This cortical plate is a neutralization plate, stabilizing the fragments from load, but relying on a lag screw for compression

Fixation / plates / buttress

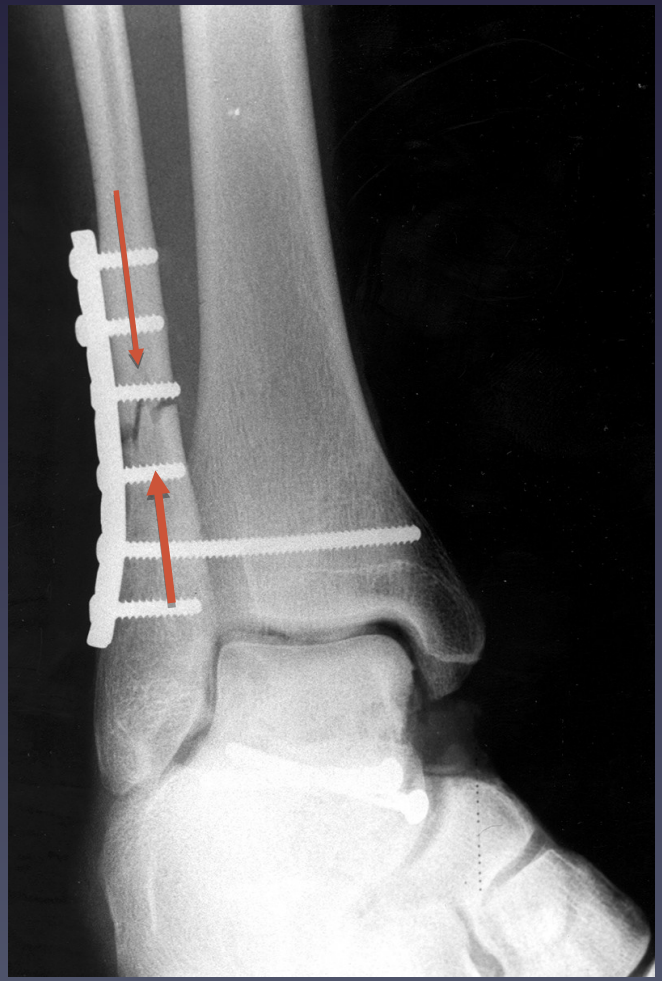
Buttress plates support fragments that are unstable in compression



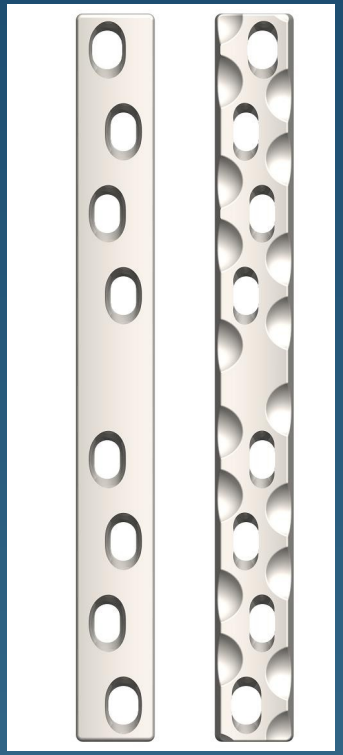
Fixation / plates / compression

Fixation / plates / compression

How can a plate apply compression parallel to the axis of the plate?



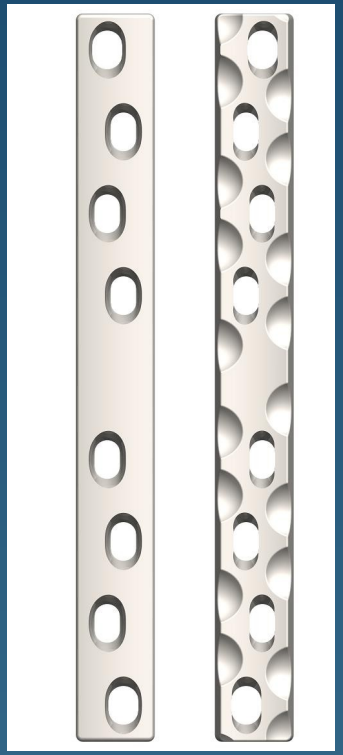
Fixation / plates / compression



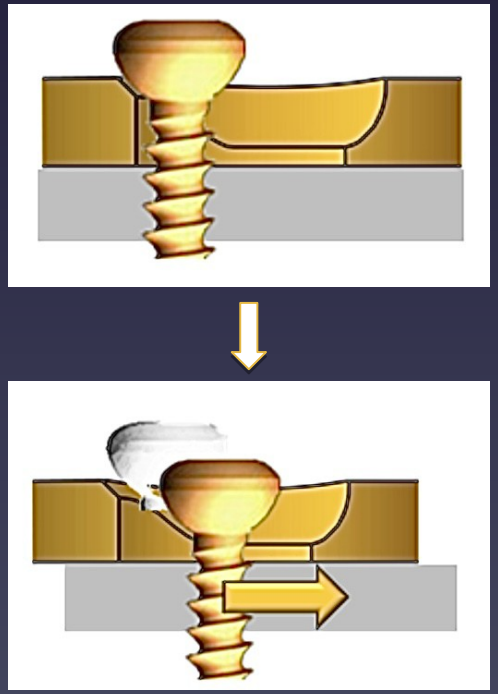
Dynamic compression plates have oval screw holes with sloped edges

Non-compression cortical plate for comparison

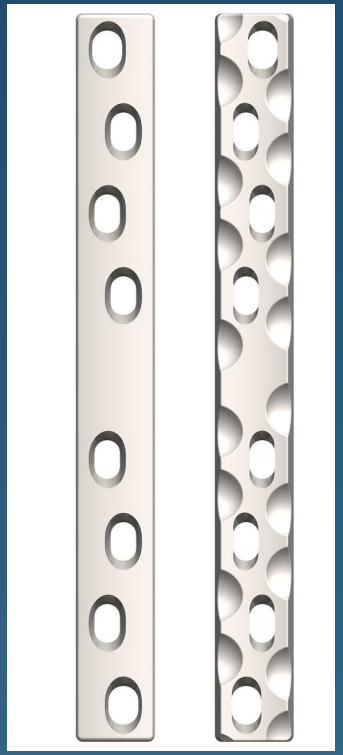
Fixation / plates / compress



Dynamic compression plates have oval screw holes with sloped edges



Fixation / plates / compress



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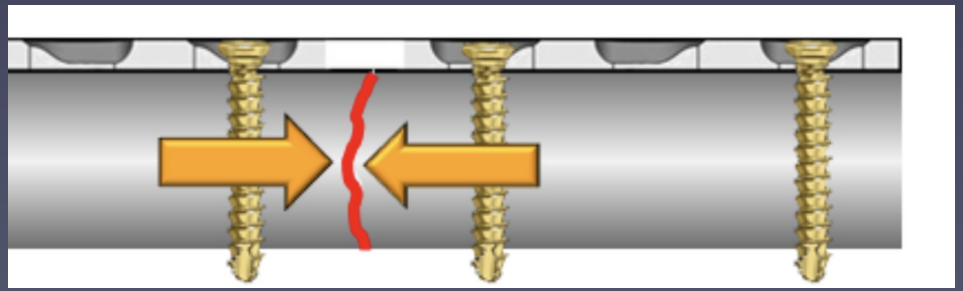
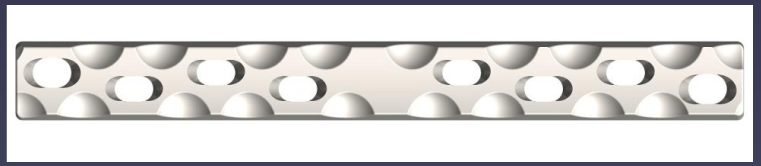
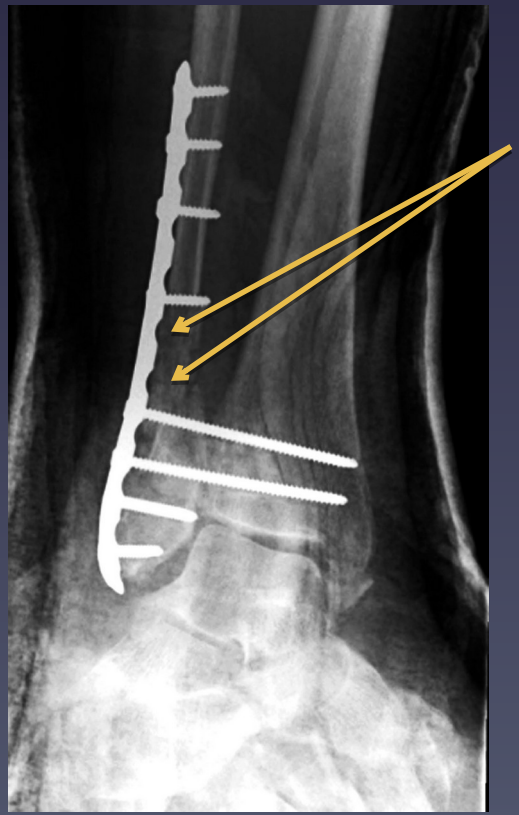


Fixation / plates / compression

Dynamic compression plate

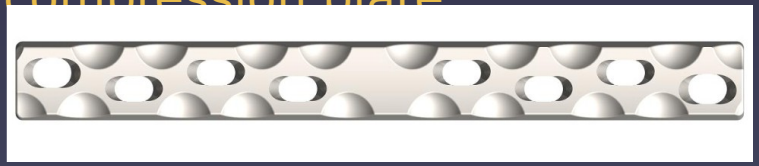


Fixation / plates / compression



Dynamic compression plate

The extra cutouts make this a low contact dynamic compression plate



Fixation / plates / locking

Locking plates and screws

The screw head is threaded, and locks into the plate

Fixation / plates / locking

Locking plates

Fixation / plates / locking

Locking plates

Look for the finely threaded locking screws

Fixation / plates / locking

Locking plates

Look for the finely threaded locking screws

Not closely pressed to bone, but rather securely locked to the screws

Fixation / plates / locking

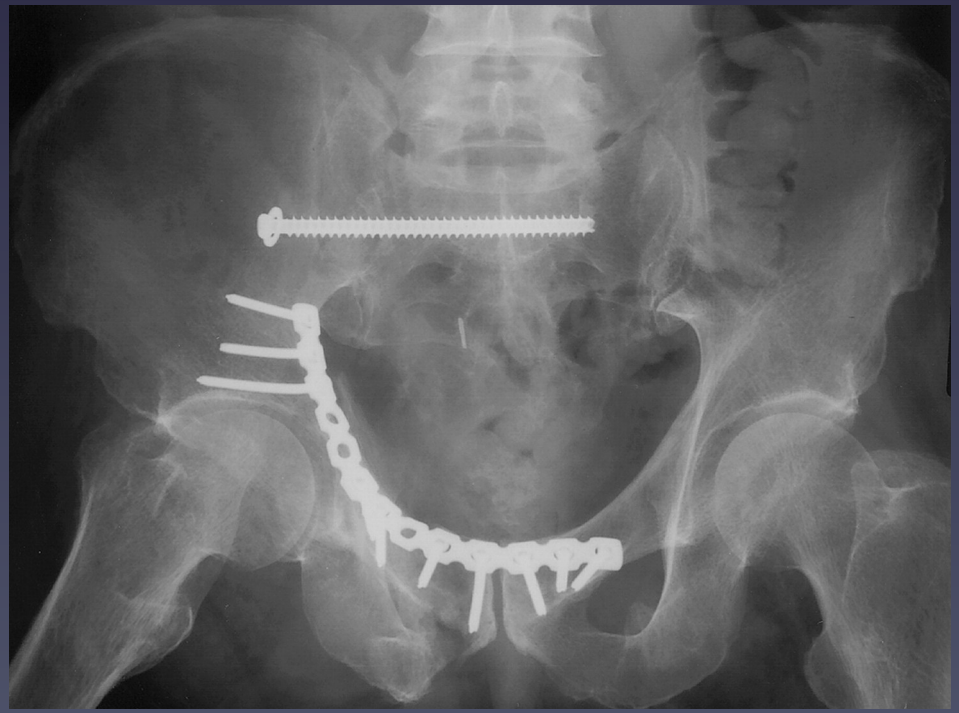
Locking plates

Look for the finely threaded locking screws

Not closely pressed to bone, but rather securely locked to the screws

A gap between cortex and bone is expected

Fixation / plates / reconstruction



Reconstruction plate

Fixation / plates / DHS and plate

Dynamic hip screw and plate

Fixation /

Is this a rod or a nail?

Fixation /

Is this a rod or a nail?

Fixation / nails

Intramedullary nails

Provide flexible fixation
Load sharing, not load-bearing

An internal splint

Fixation / nails

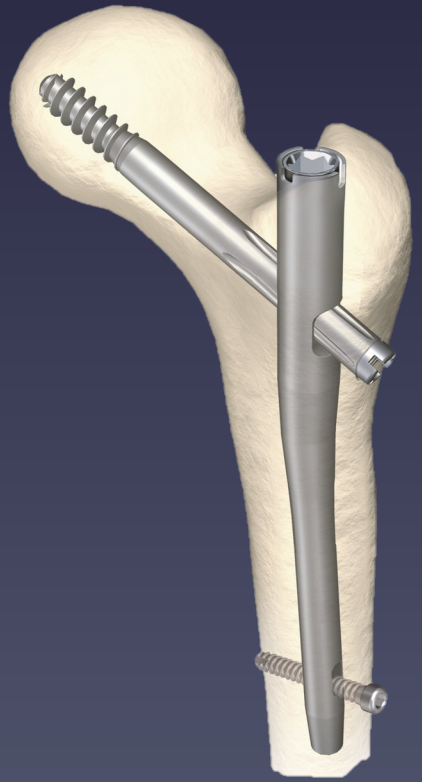
Intramedullary nails

Provide flexible fixation
Load sharing, not load-bearing

An internal splint

- ✓ Do not require opening of the fracture site
- ✓ Preserve hematoma at fracture site

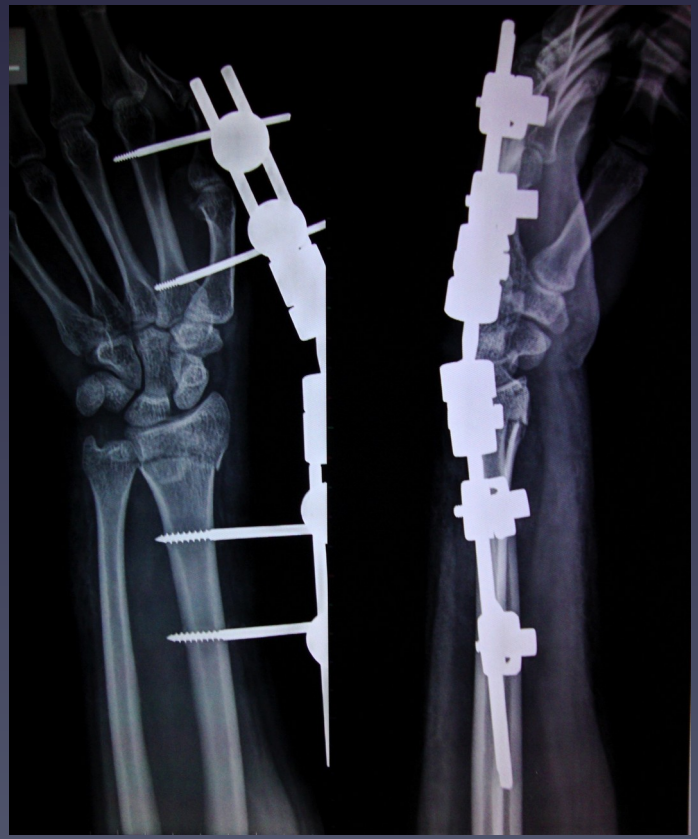
Fixation / nails



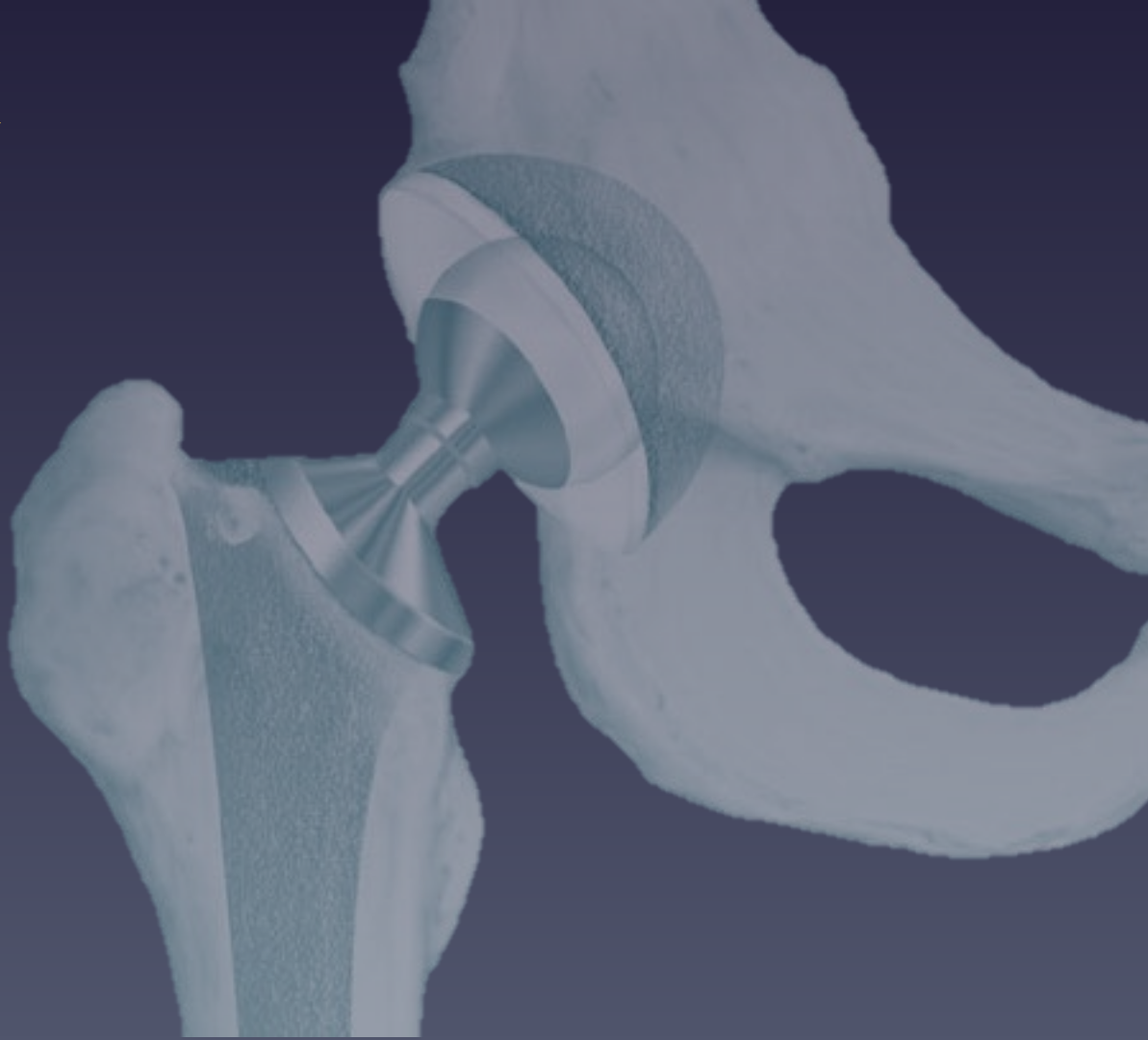
Cephalomedullary nail

Fixation / nails vs rods

Fixation / external fixation



Arthroplasty



Arthroplasty

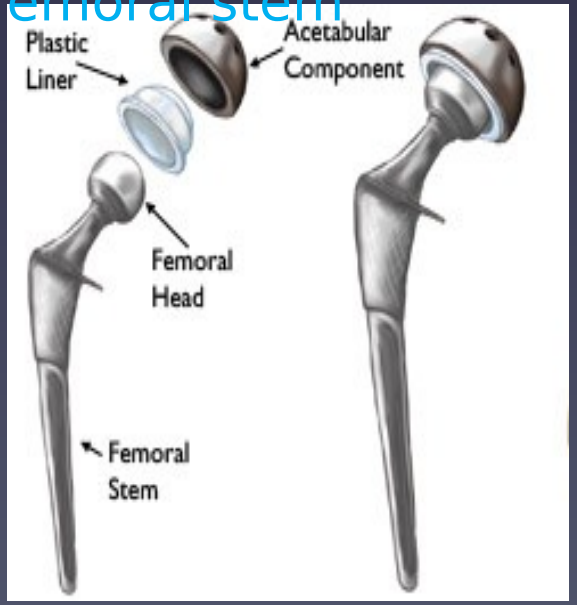
Total arthroplasty or hemiarthroplasty
Unicompartmental
Cemented or uncemented
Unconstrained, semi-constrained, constrained
Screwed
Press-fit

Arthroplasty / hip

Total hip arthroplasty
with cemented
femoral stem

Arthroplasty / hip

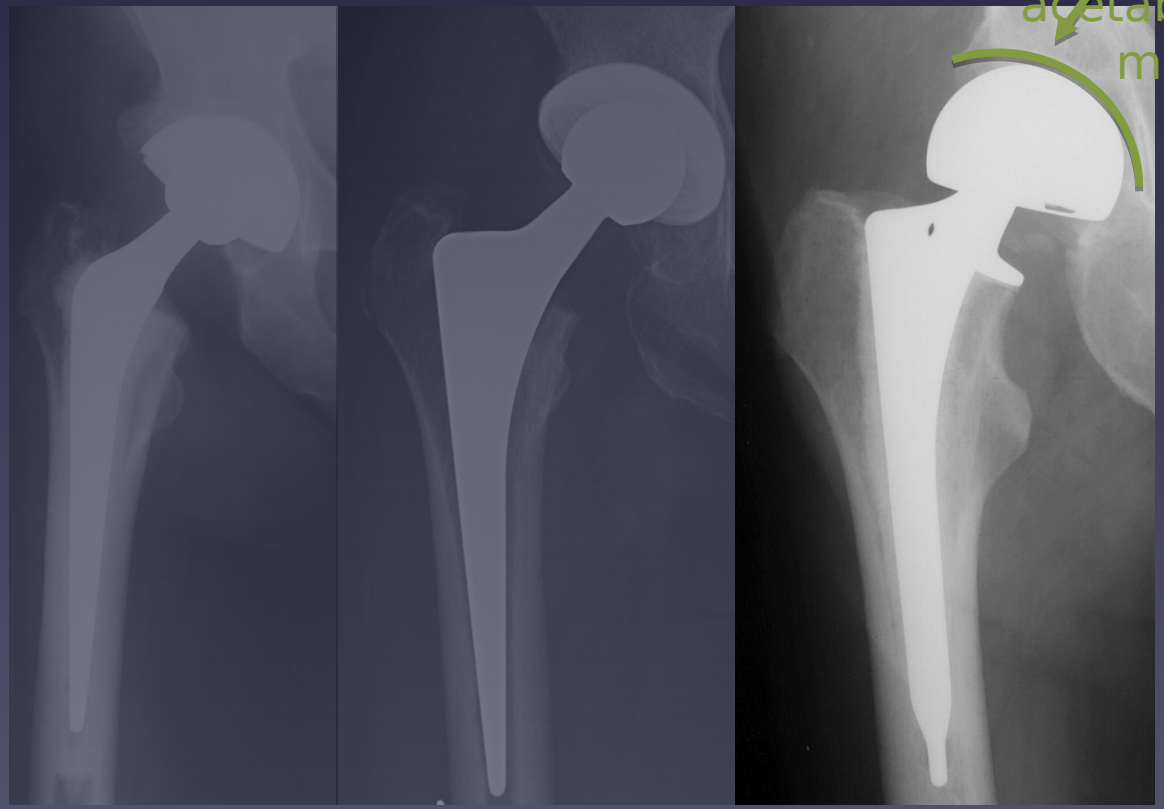
Total hip arthroplasty with cemented femoral stem



Arthroplasty / hip

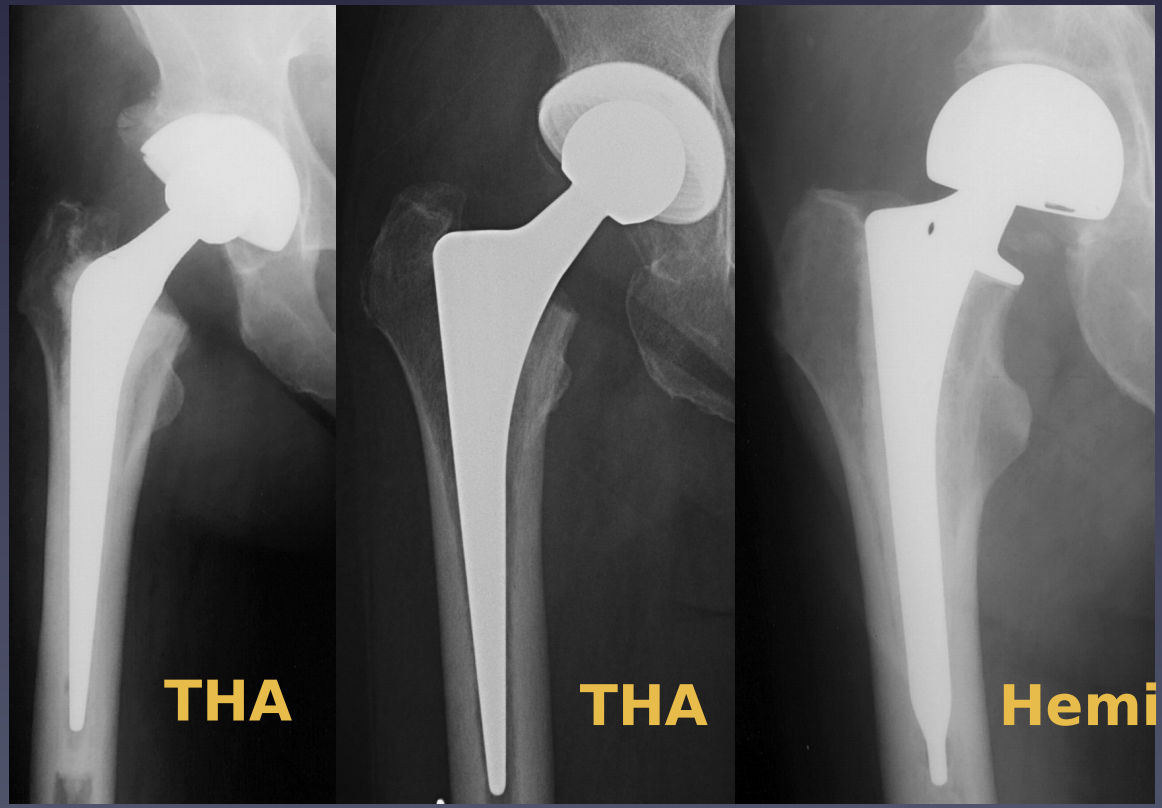
Total arthroplasty
with press-fit stem

Arthroplasty / hip



Hemiarthroplasty (bipolar) with cemented femoral stem

Arthroplasty / hip

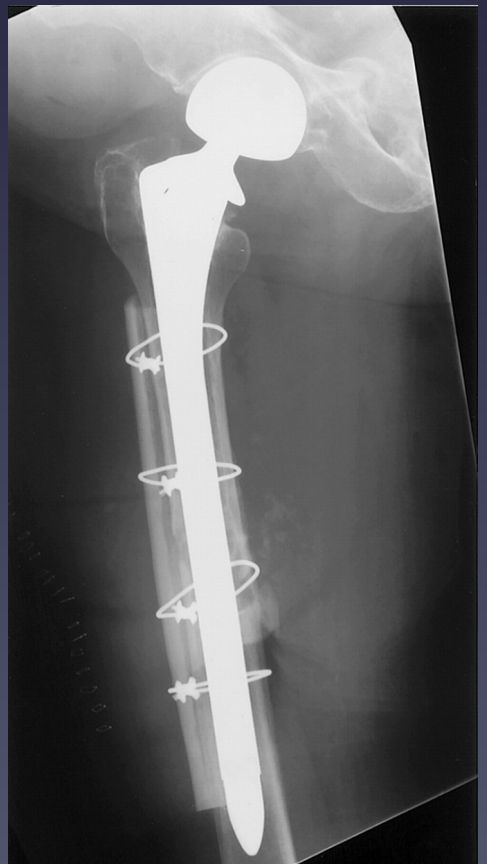


Arthroplasty / hip

Resurfacing arthroplasty

Preserves native bone stock
Younger patients

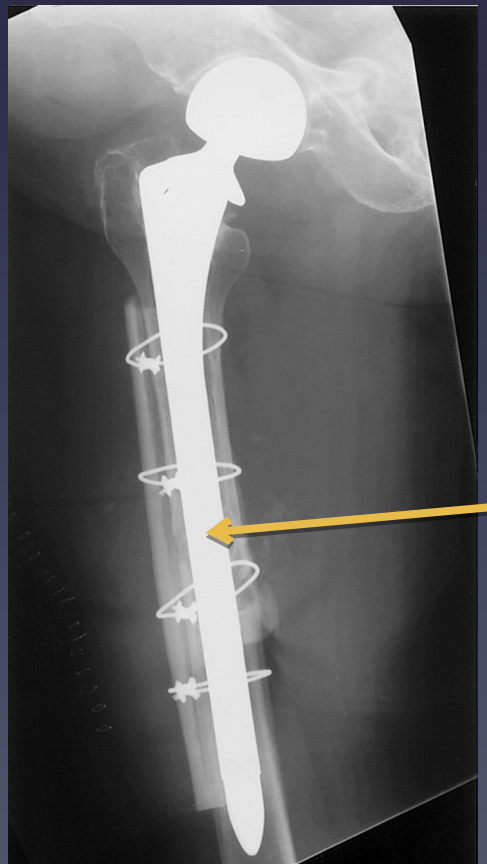
Arthroplasty / hip



Revision hip arthroplasty

After failure of a prosthesis, a more extensive implant is needed to fixate in healthy native bone

Arthroplasty / hip

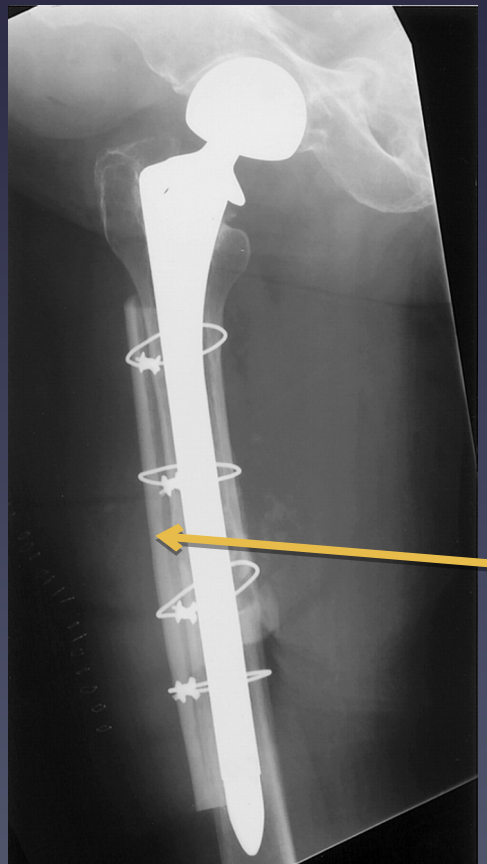


Revision hip arthroplasty

After failure of a prosthesis, a more extensive implant is needed to fixate in healthy native bone

- Longer femoral stem

Arthroplasty / hip



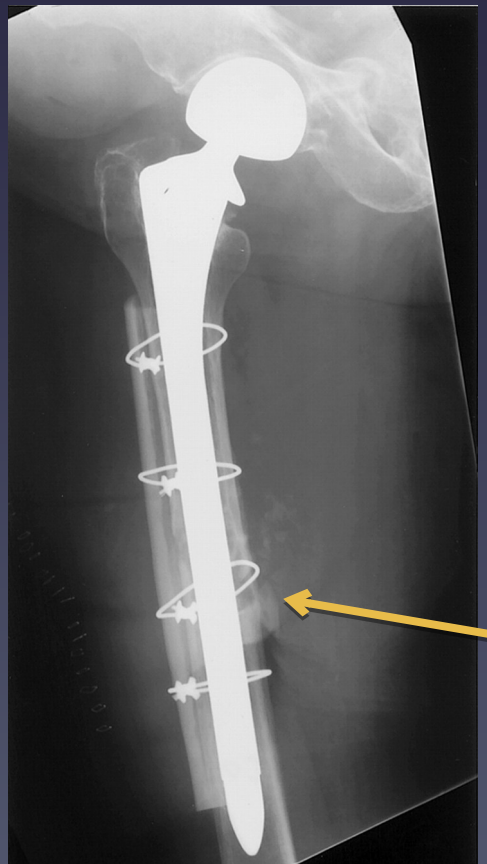
Revision hip arthroplasty

After failure of a prosthesis, a more extensive implant is needed to fixate in healthy native bone

Longer femoral stem

Onlay allograft

Arthroplasty / hip



Revision hip arthroplasty

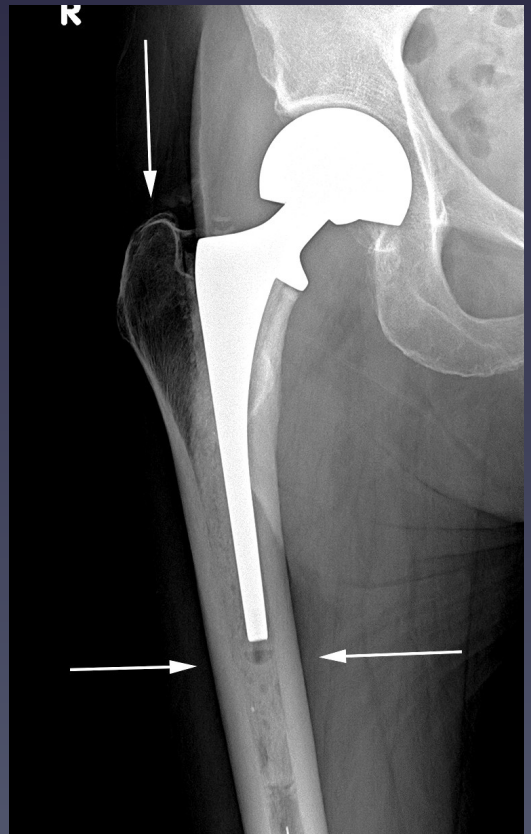
After failure of a prosthesis, a more extensive implant is needed to fixate in healthy native bone

Longer femoral stem

Onlay allograft

Cerclage wires

Arthroplasty / stress shielding



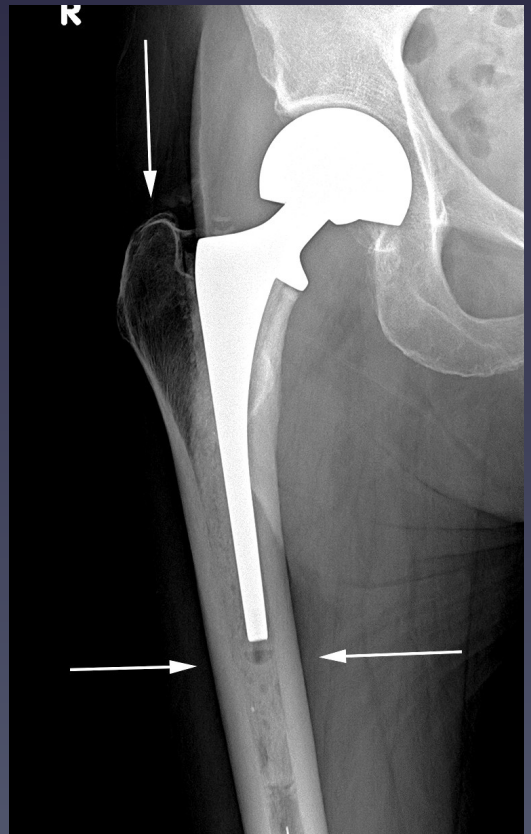
Natural history of a prosthesis

Less load on native bone

↓

Demineralization “stress shielding”

Arthroplasty / stress shielding



Natural history of a prosthesis

Less load on native bone

↓

Demineralization “stress shielding”

↓

Loosening, component wear

↓

Revision

Arthroplasty / knee

Arthroplasty / knee

Total knee arthroplasty

Unconstrained

Arthroplasty / knee

Total knee arthroplasty
Unconstrained

Total knee arthroplasty
Constrained

Arthroplasty / knee

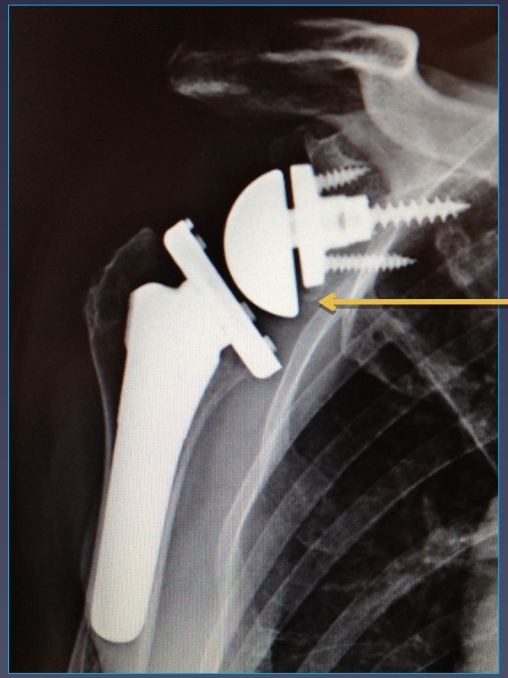
Total knee arthroplasty
Unconstrained

Total knee arthroplasty
Constrained

Unicompartmental arthroplasty

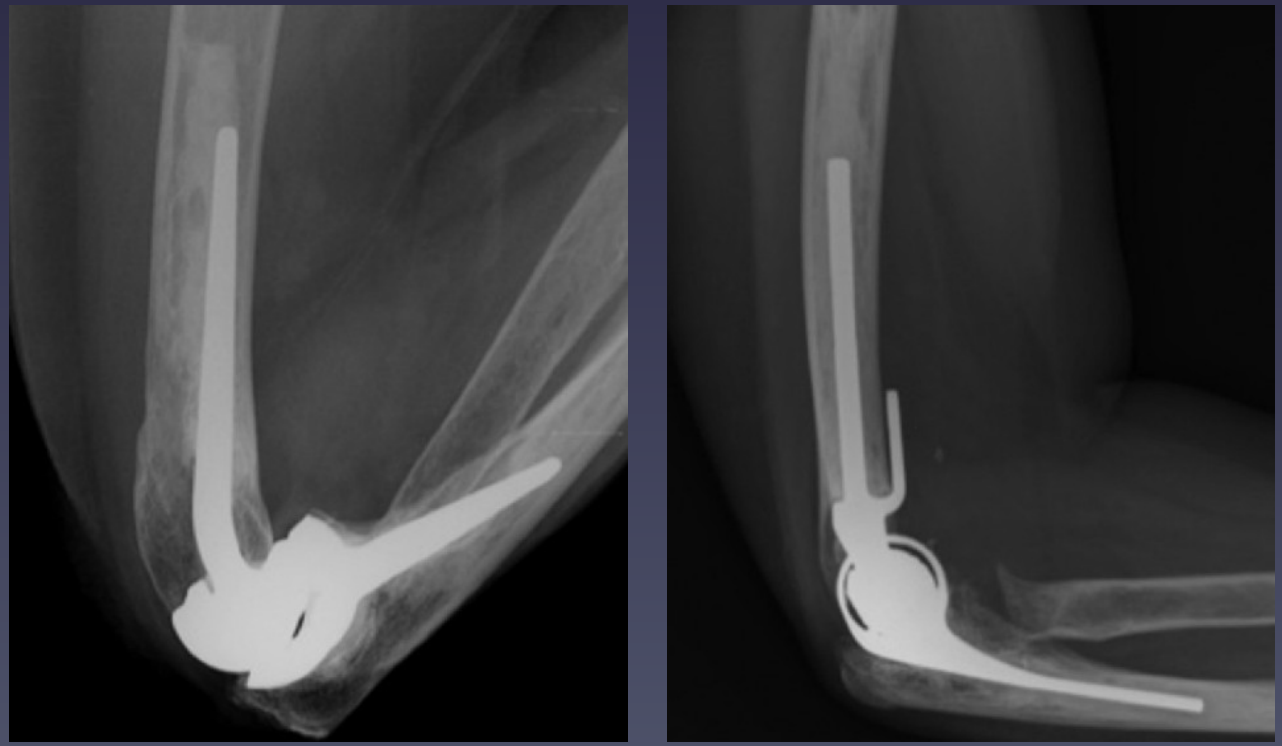
Arthroplasty / shoulder

Anatomic GHA



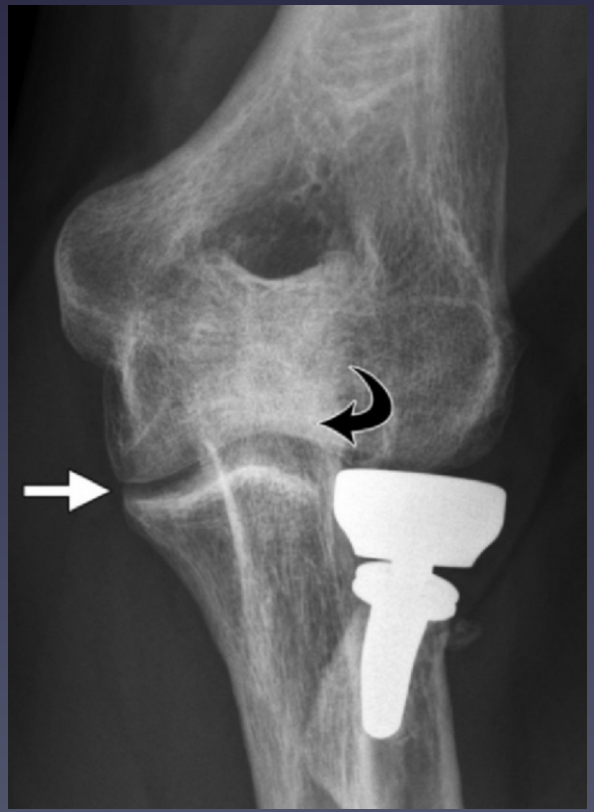
Reverse GHA

Arthroplasty / elbow



Arthroplasty / radial head replacement

Arthroplasty / radial head replacement



This shows an “overstuffed” radial head, sized too large for this patient

Arthroplasty / MCP

Silastic implants

Miscellaneous / shoulder

Miscellaneous / shoulder

Suture anchors for rotator cuff tendon repair

Miscellaneous / shoulder

Suture anchors for rotator cuff tendon repair

Subacromial decompression with distal clavicular resection “Mumford procedure”

Miscellaneous / shoulder

Suture anchors for rotator cuff tendon repair

Subacromial decompression with distal clavicular resection “Mumford procedure”

Labral repair

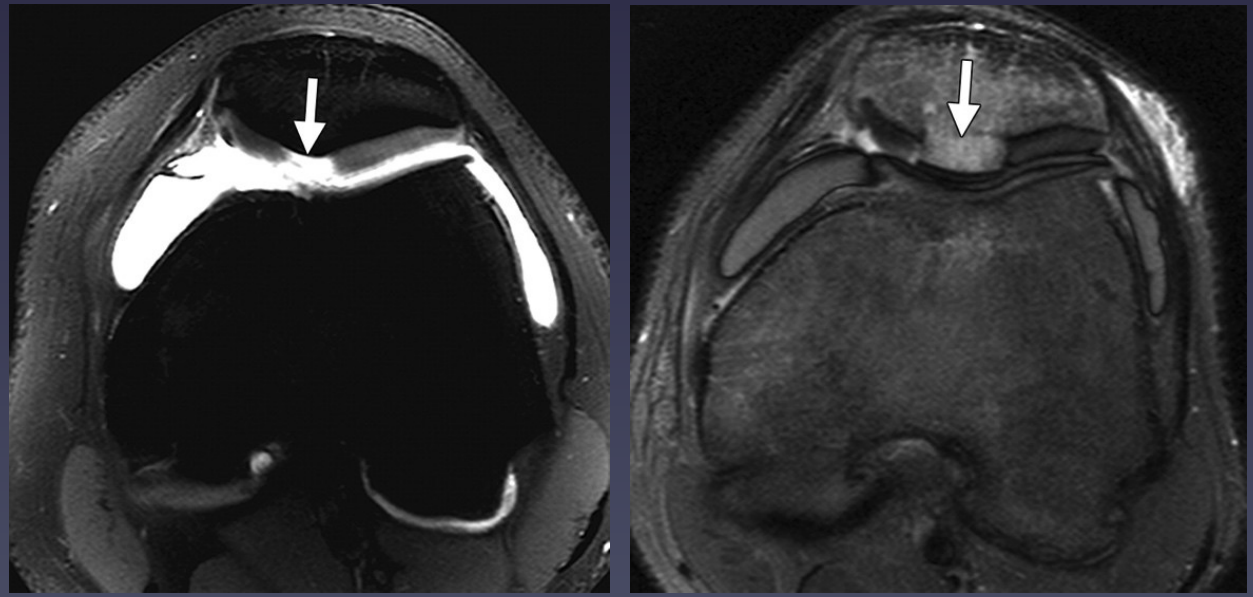
Miscellaneous / ACL reconstruction

Tendon graft placed in femoral and tibial tunnels, fixed with hardware

Interference screws

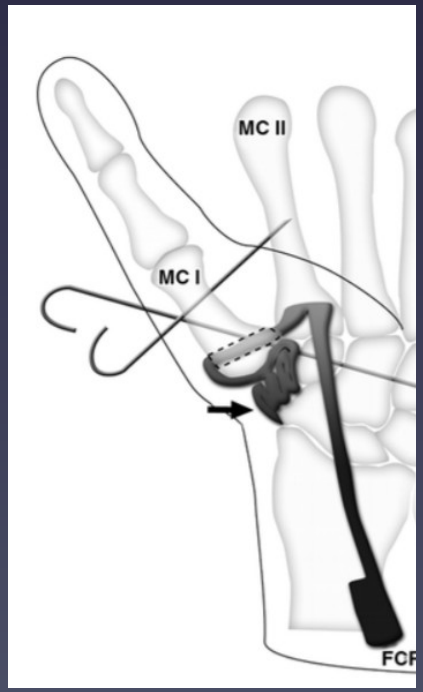
Endobuttons

Miscellaneous / osteoarticular transplant (OAT)



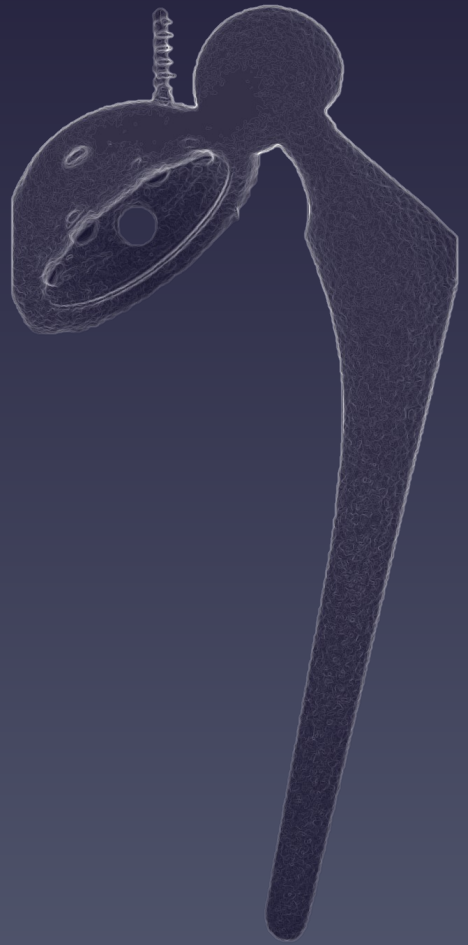
Miscellaneous / basal joint osteoarthritis

Advanced CMC OA



Trapeziectomy with LRTI (ligament reconstruction tendon interposition)

Complications /



Complications /

Complications / screw loosening

Screw fracture
Screw loosening

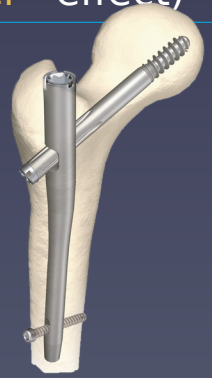
Lucency > 1 mm surrounding a screw indicates loosening

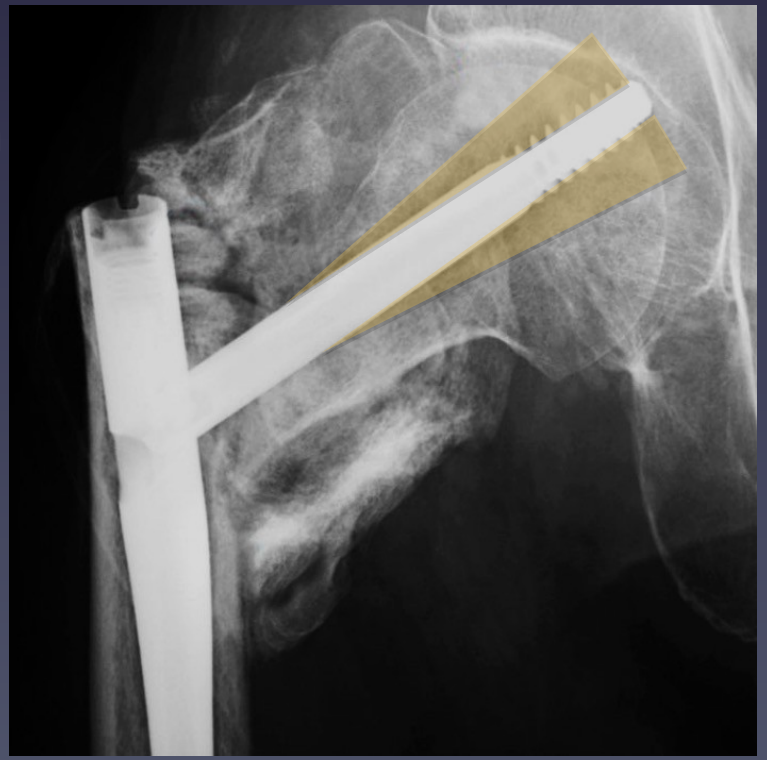
Complications /

Complications / screw loosening

Screw loosening
Screw penetration
Heterotopic ossification

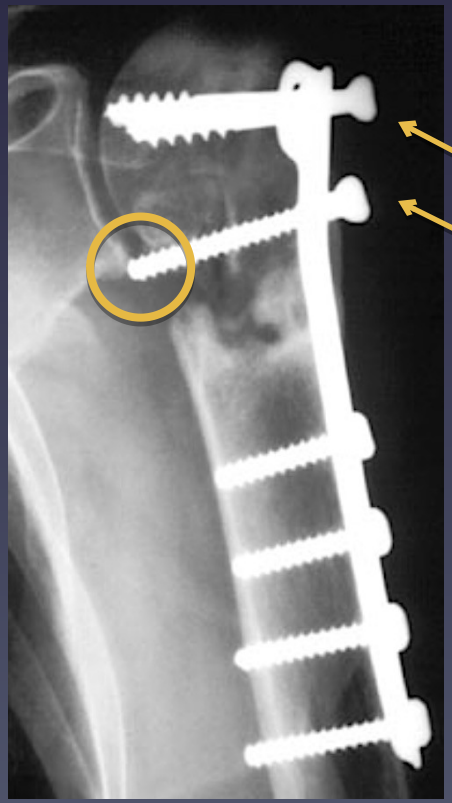
Lucency often wider near screw tip due to motion (“windshield wiper” effect)





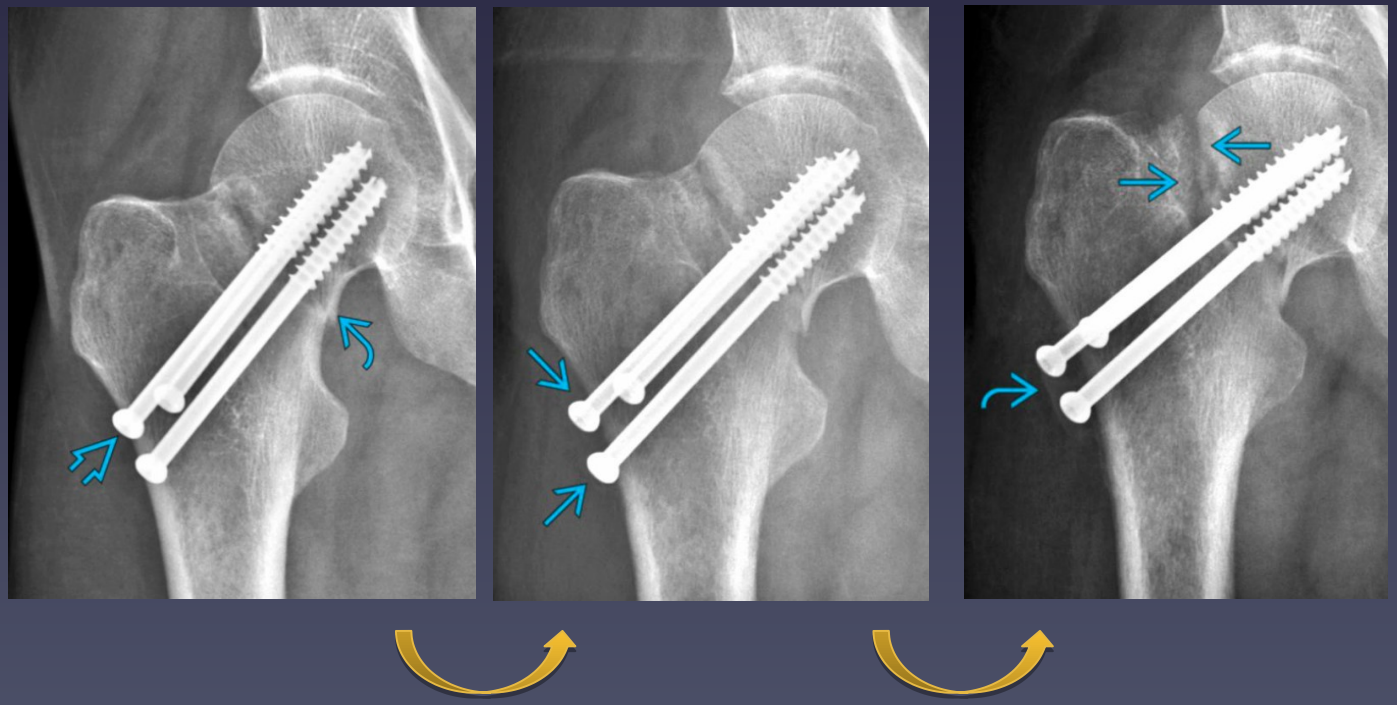
Complications /

Complications / screw loosening

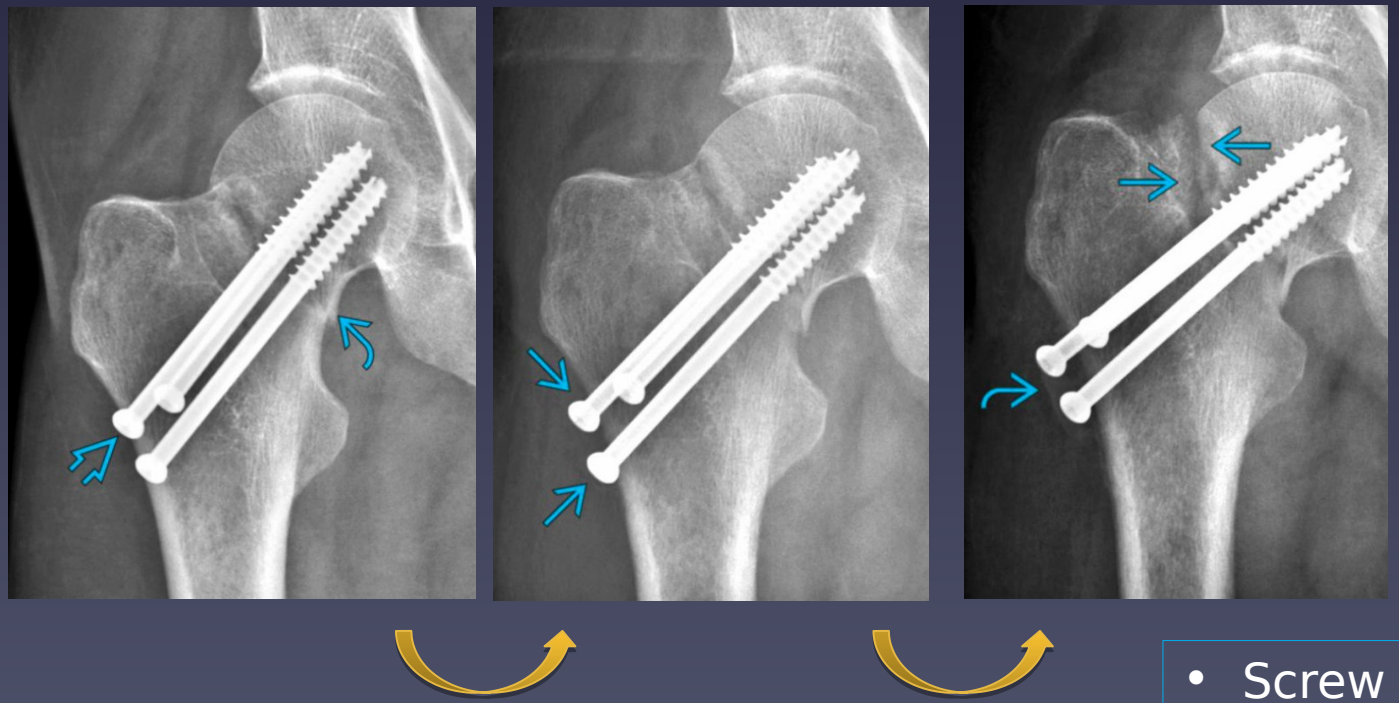


Screw backout
Screw penetration

Complications / screw loosening

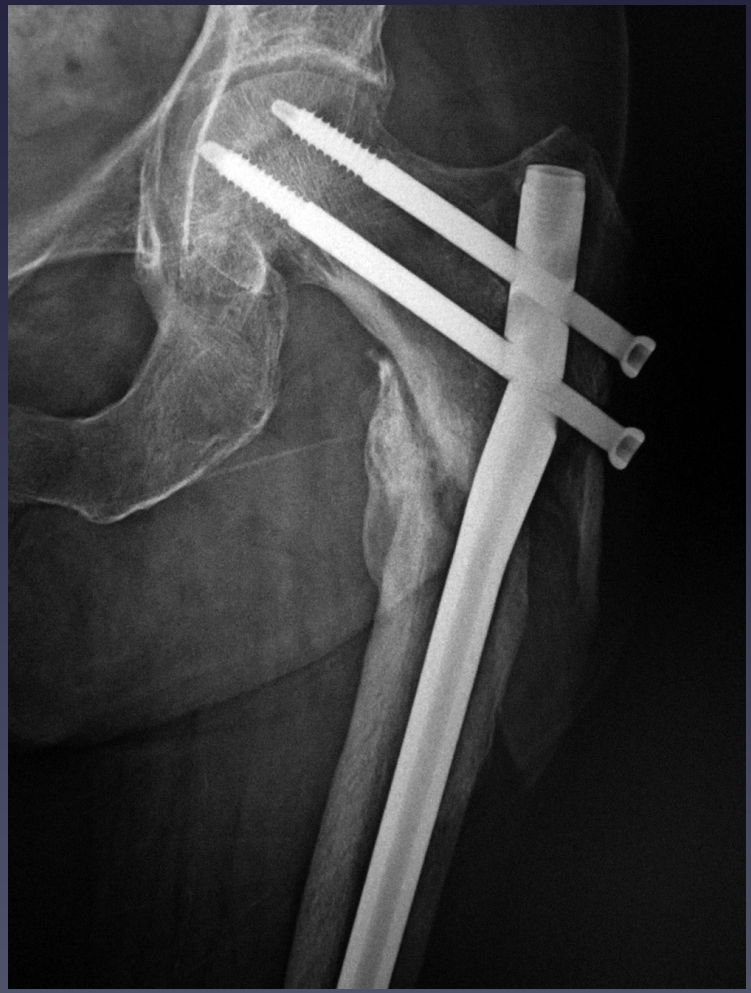


Complications / screw loosening



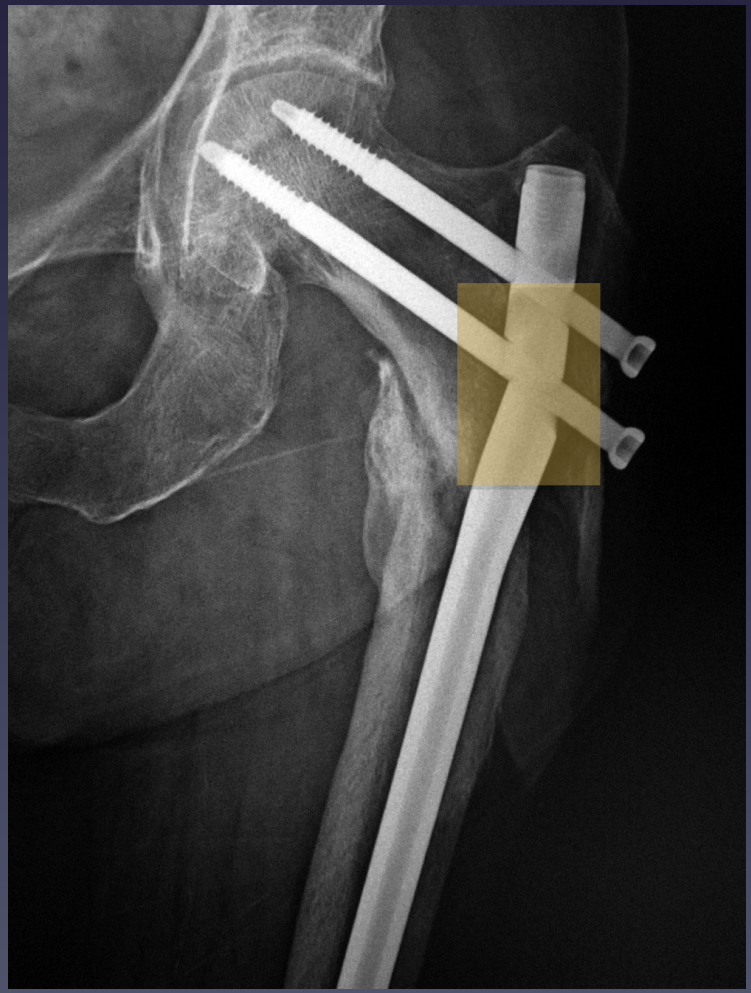
- Screw backout
- Non-union

Complications /



Complications / hardware fracture

- Nail fracture
- Non-union



Complications /

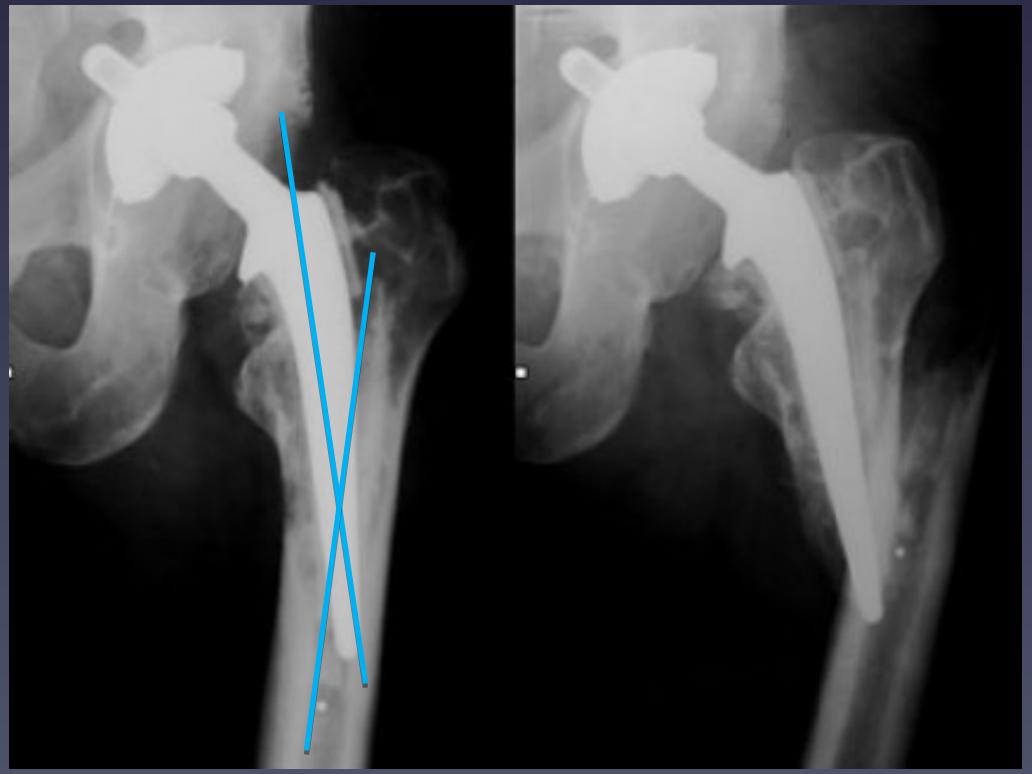
Complications / fracture

Periprosthetic fracture

Often occurs at tip of prosthetic stem

Complications / fracture

Varus alignment of prosthesis predisposes to fracture



Complications /

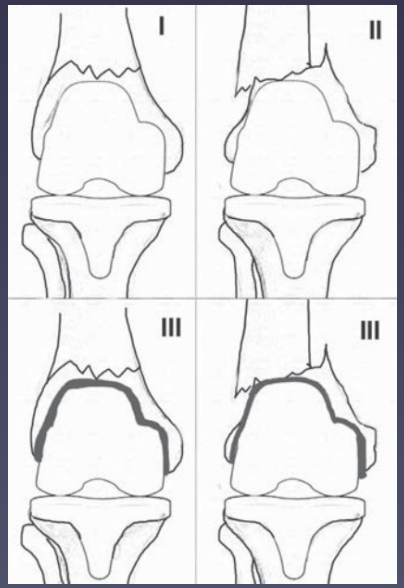
Complications / fracture

Cement fracture

Complications /

Complications / fracture

Supracondylar femoral fracture



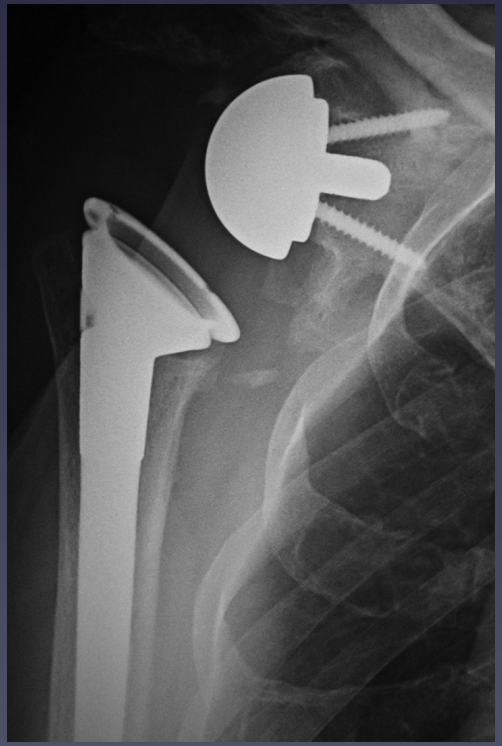
Classified based on presence of displacement and loosening

Complications /

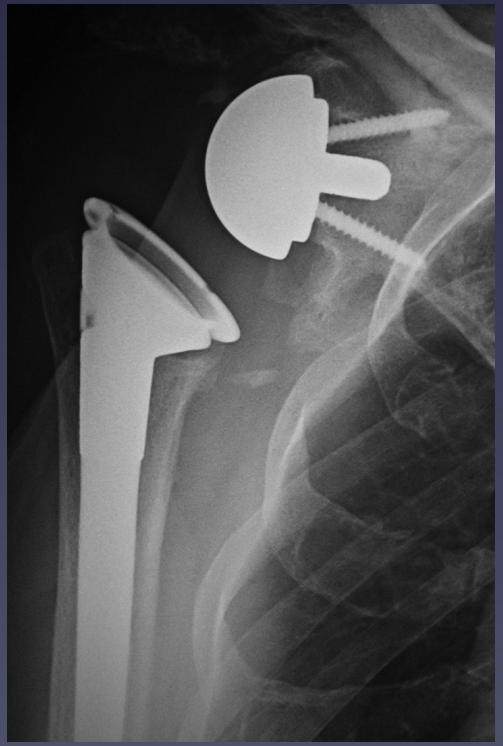
Complications / dislocation

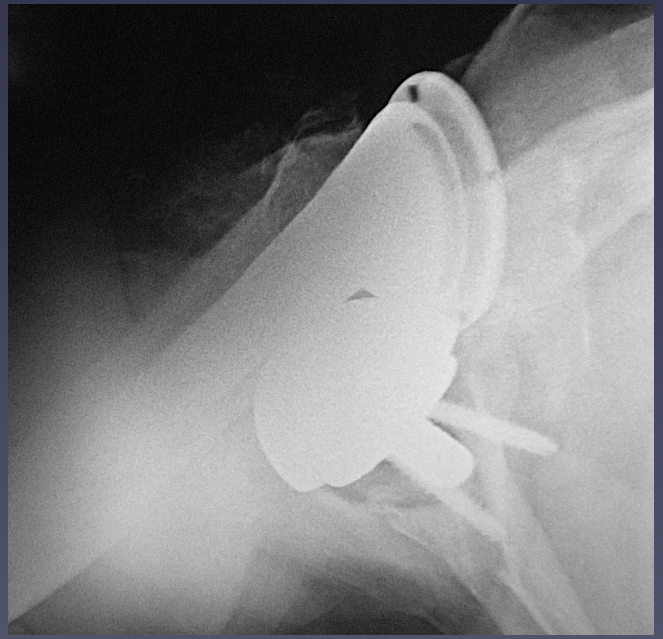
Dislocated hip prosthesis

Complications /

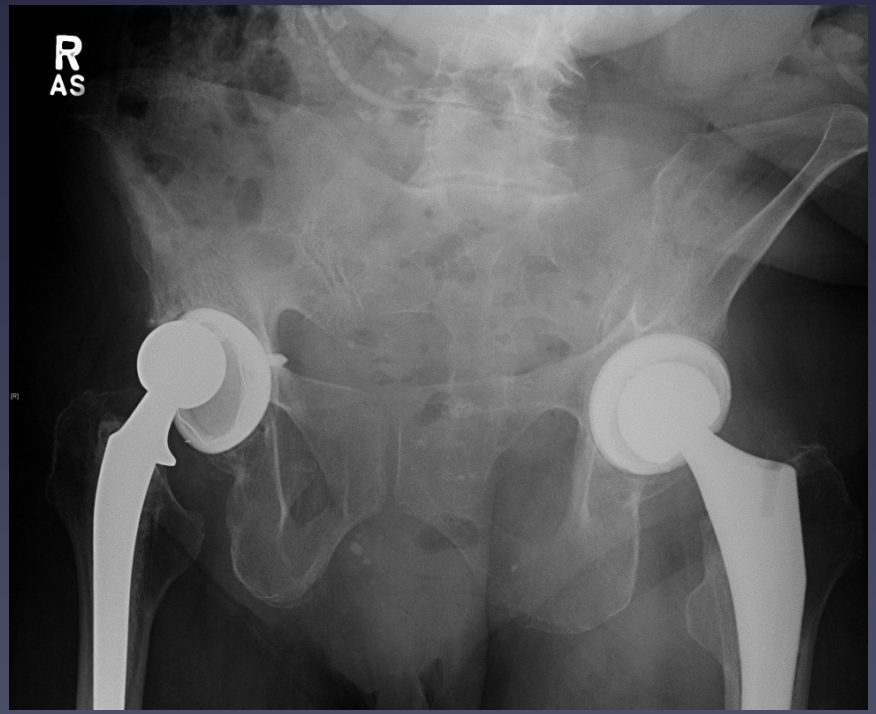


Complications / dislocation

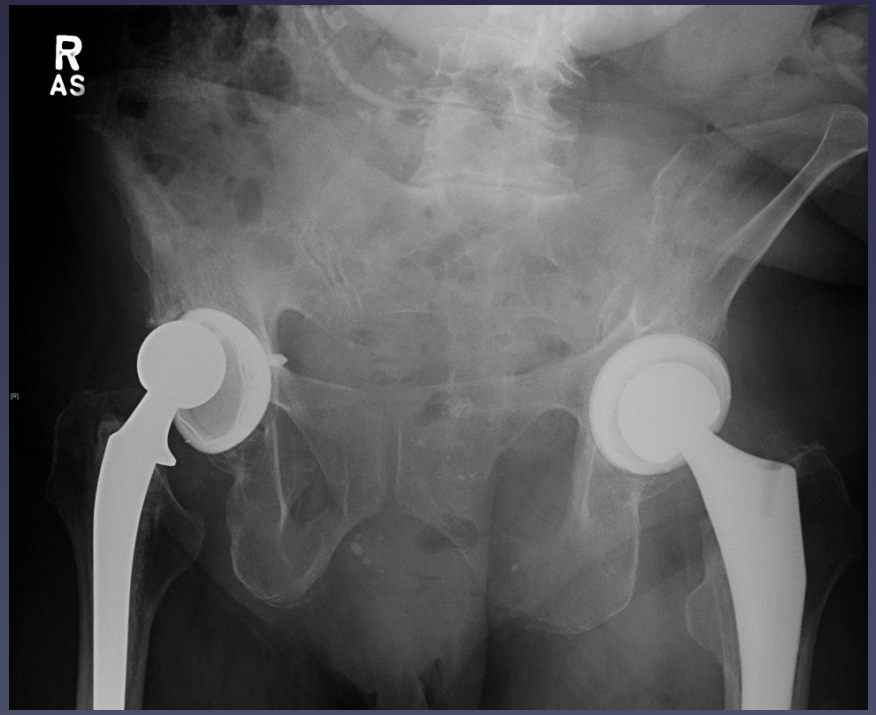




Complications / dislocation

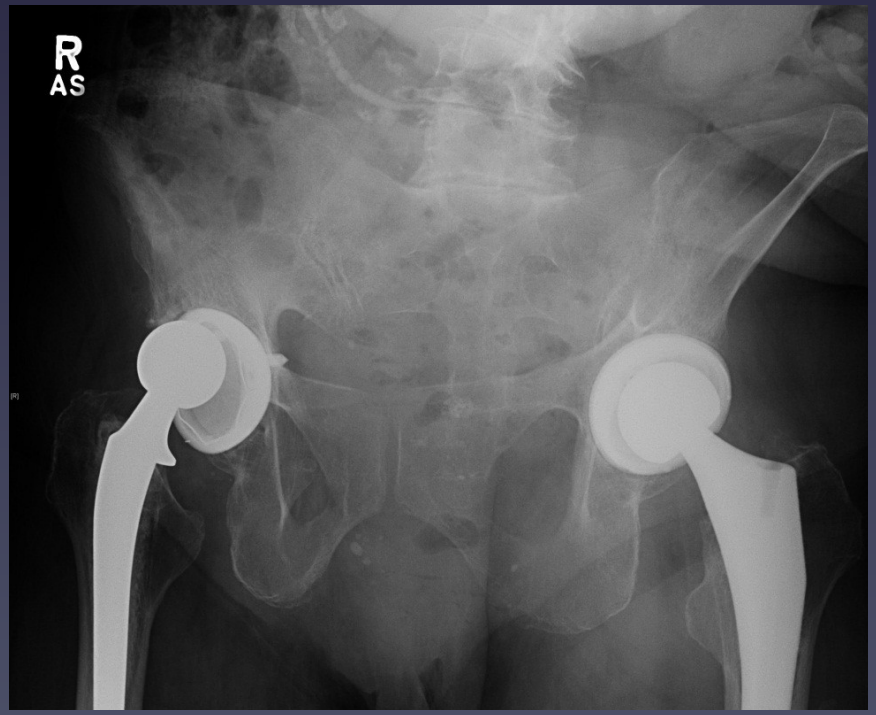


Complications / dislocation

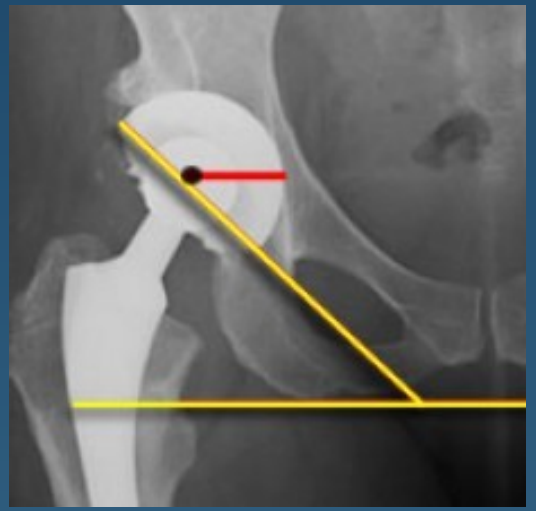


Femoral head slippage due to excessive acetabular inclination

Complications / dislocation



Femoral head slippage due to excessive acetabular inclination



Normal acetabular lateral inclination is 30-50 degrees

Complications /

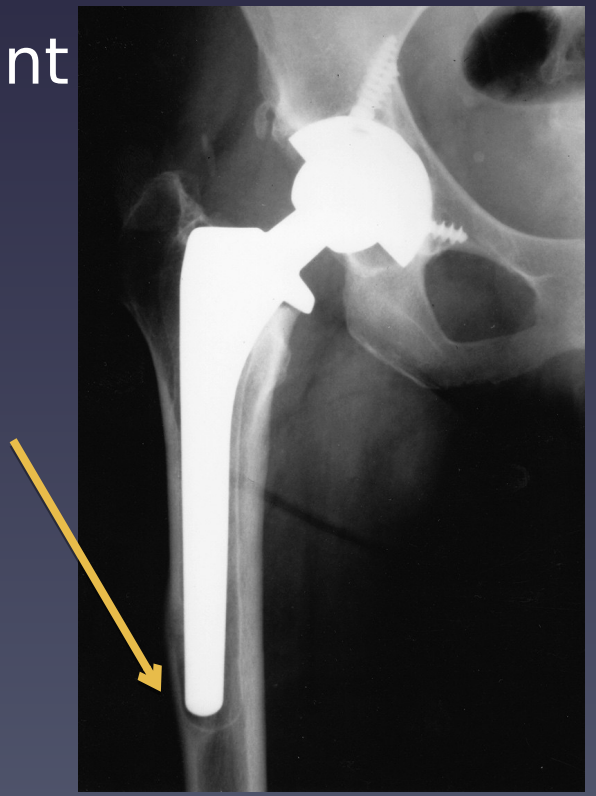
Complications / dislocation

Dislocated radiolucent mobile bearing component

Complications /

Complications / loosening

Loosened femoral component



Complications / loosening

Loosened femoral component

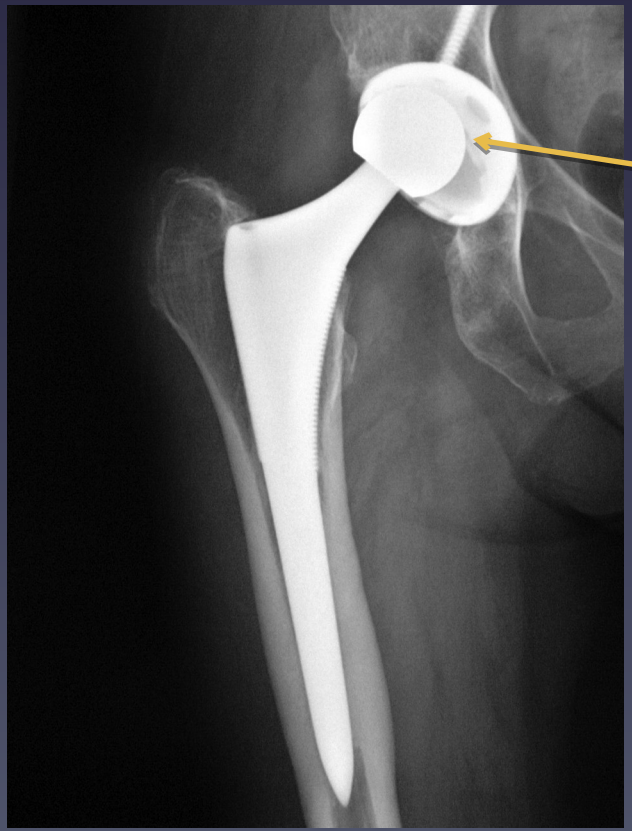
Lucency > 2 mm at bone-prosthesis or bone-cement interface

Other features of loosening:

- Component migration
- Component tilting
- Subsidence > 10 mm

Complications /

Complications / liner wear



Liner wear

Asymmetry of femoral head in acetabular cup from erosion of liner

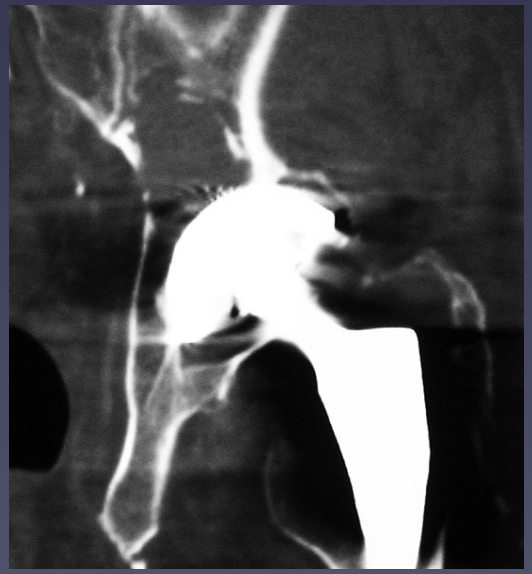
Polyethylene liner

Complications /

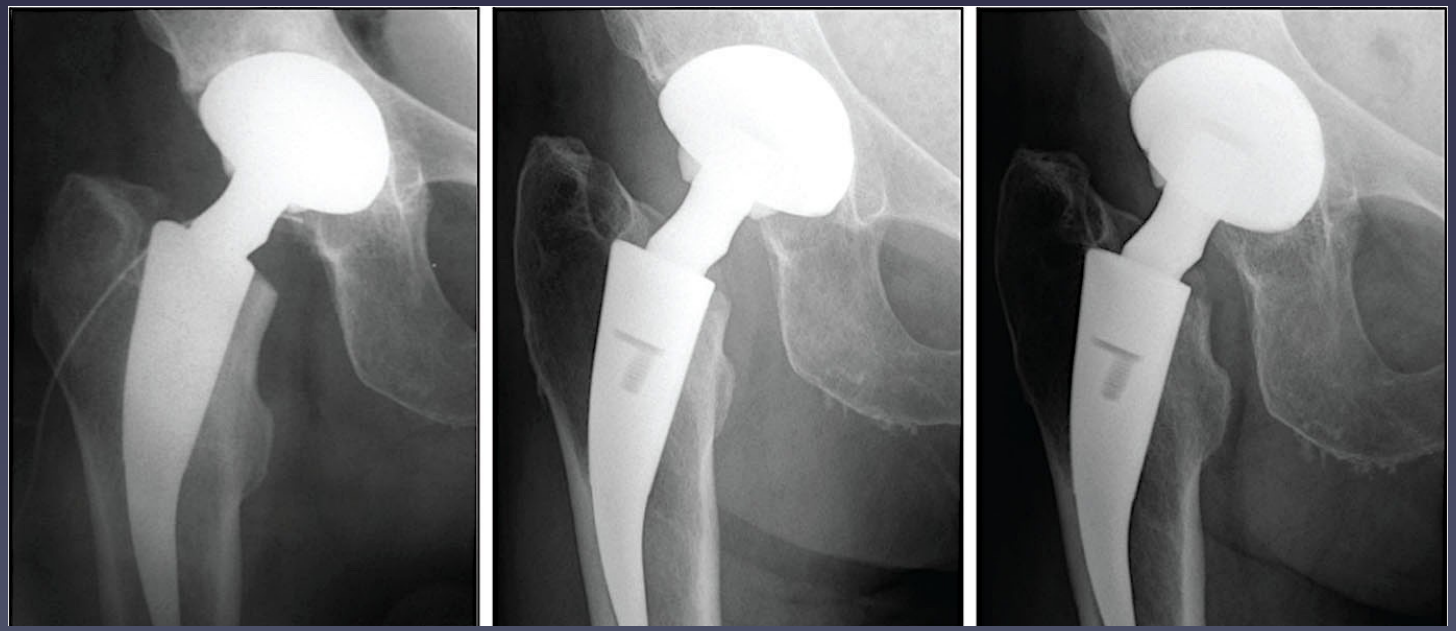
Complications / particle disease

- Liner wear
- Osteolysis

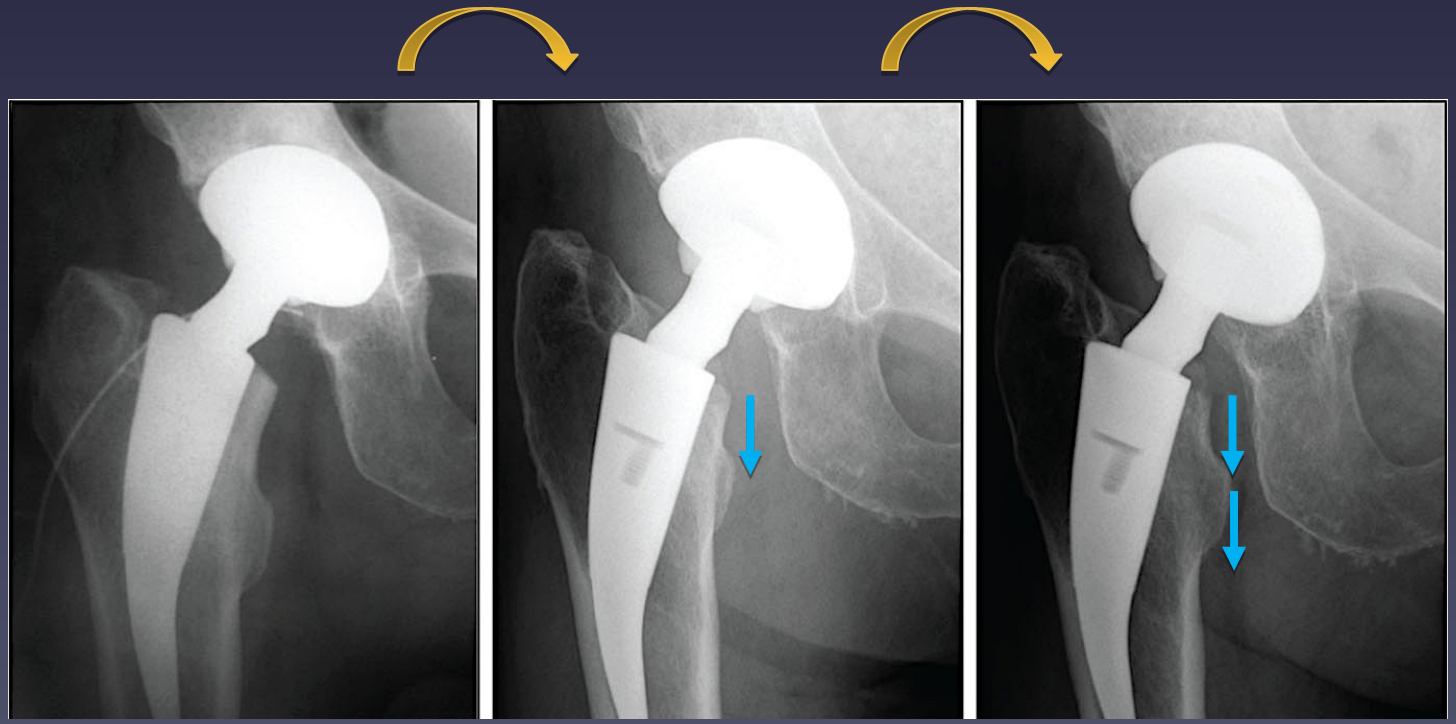
Shedded liner particles accumulate and result in synovitis and osteolysis, called “particle disease”



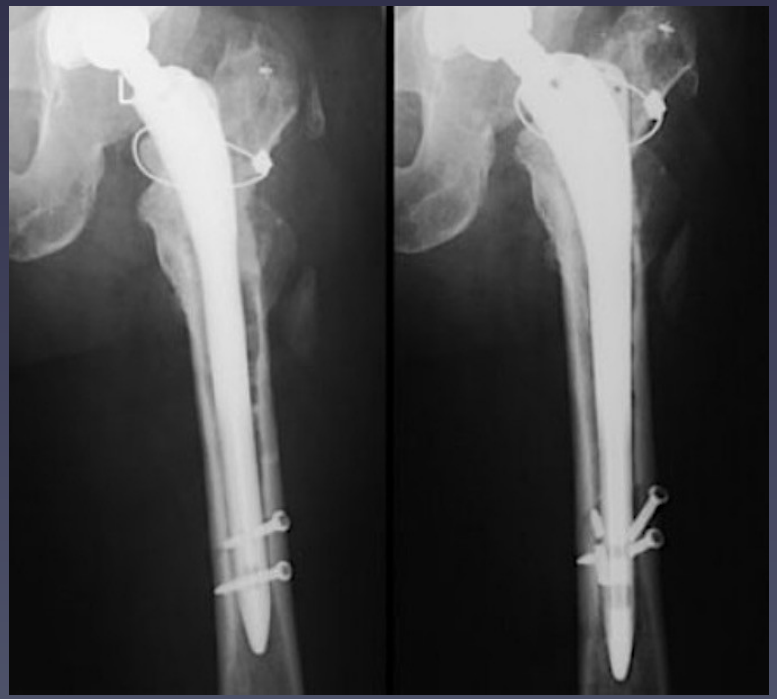
Complications /



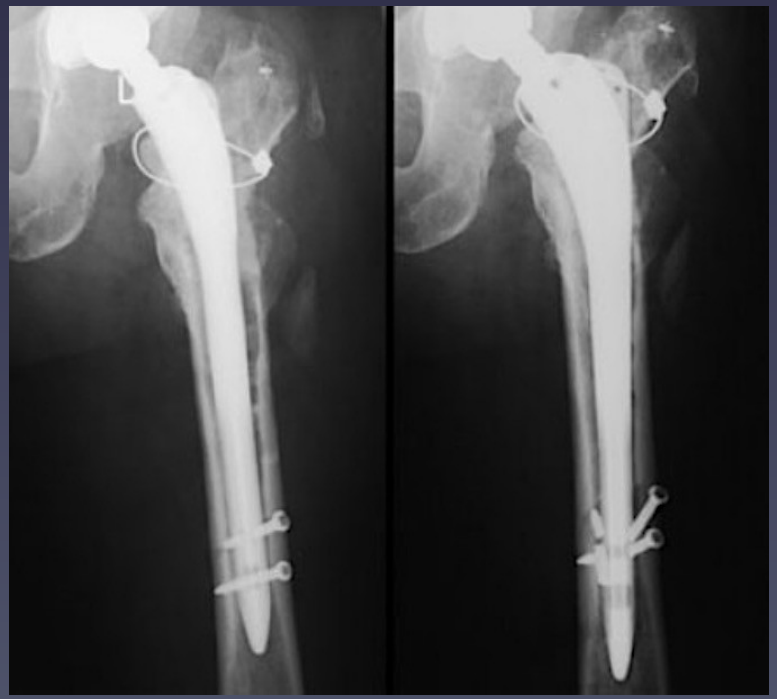
Complications / subsidence



Complications /

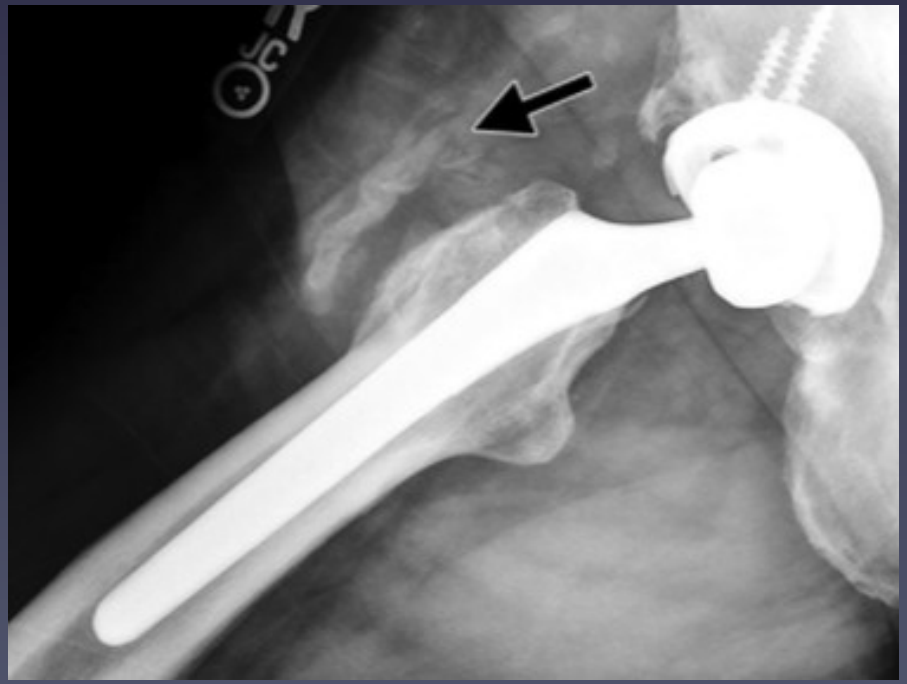


Complications / subsidence

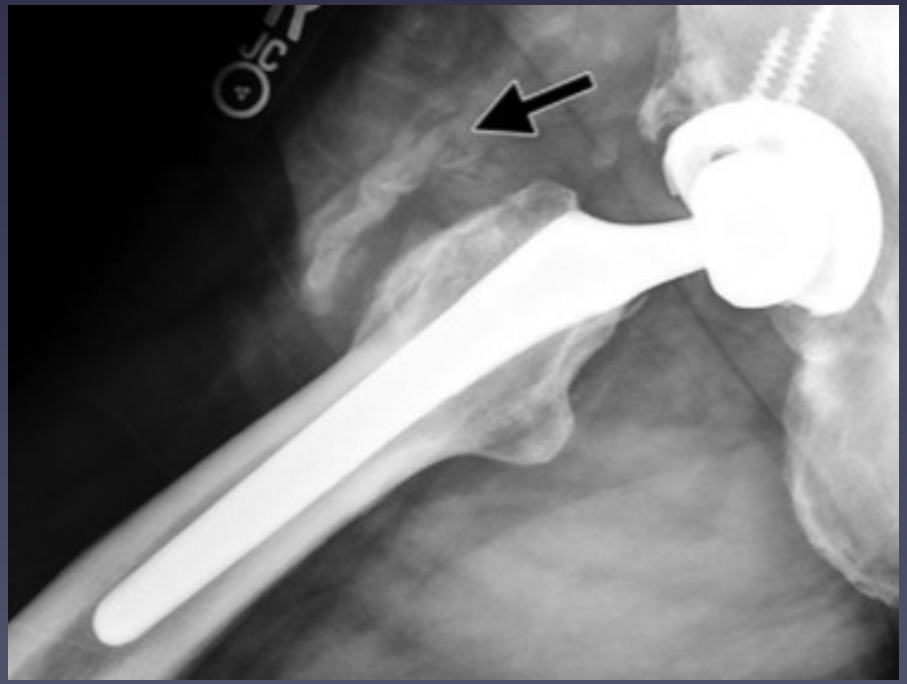


- Subsidence (“sinking”)
- Screw fracture

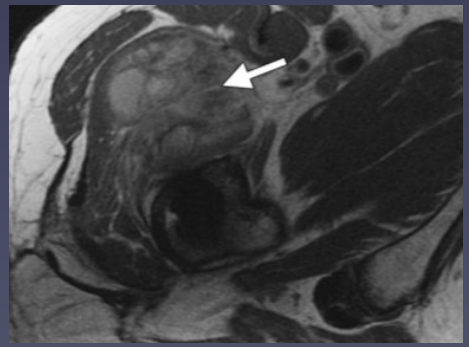
Complications /



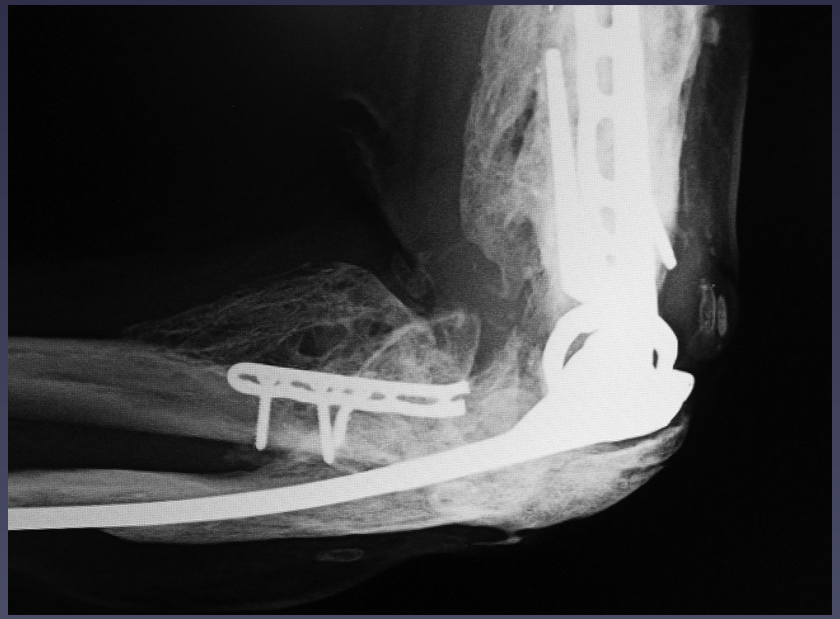
Complications / HO



Heterotopic ossification



Complications / HO



Complications /

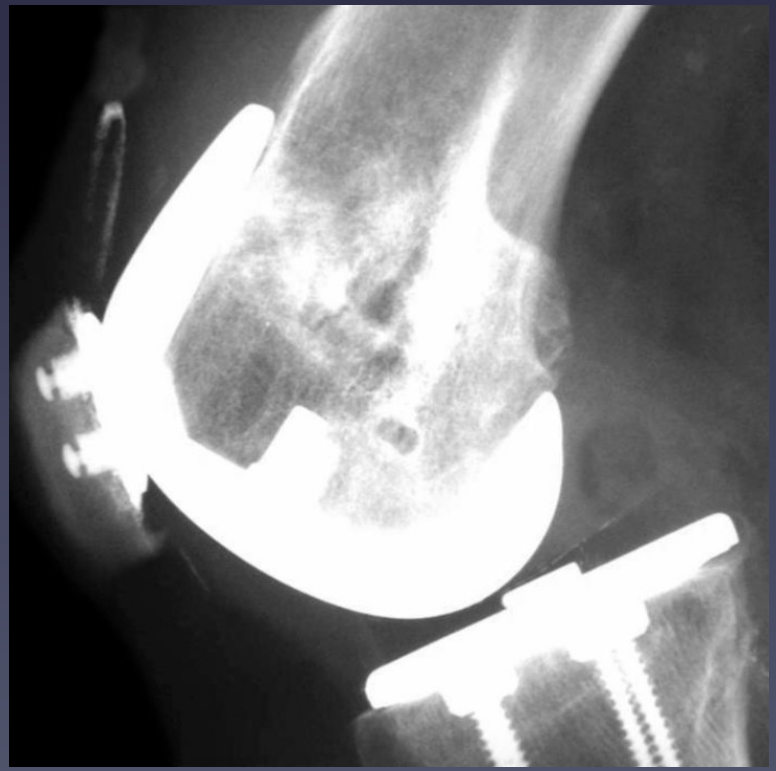
Complications / septic loosening

Loosening (septic)

Difficult to distinguish radiographically from sterile loosening

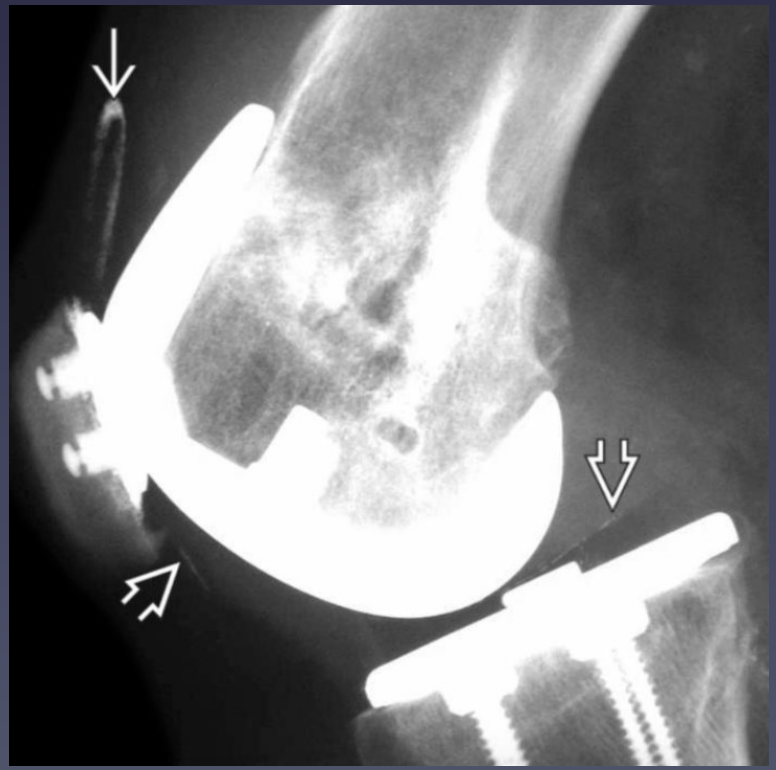
- Periprosthetic lucency
- Periostitis

Complications /



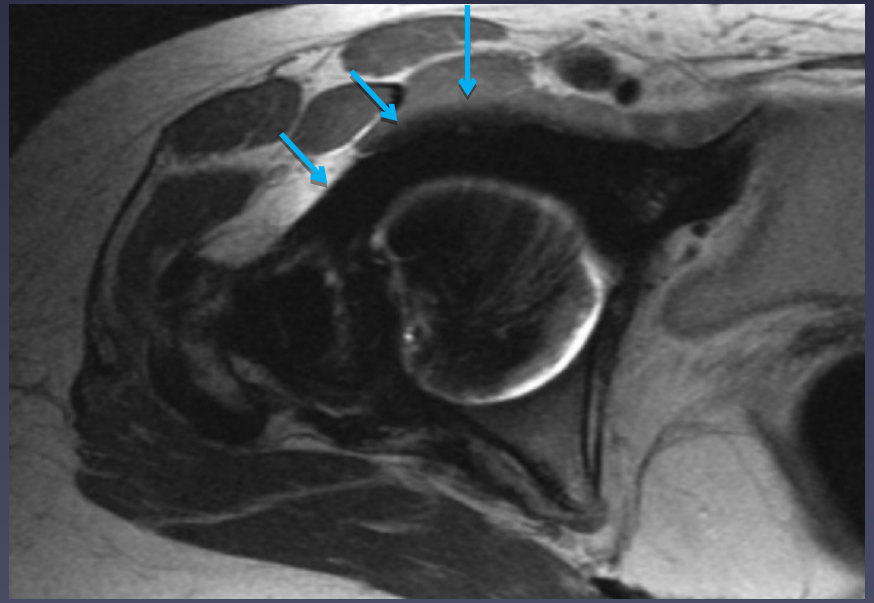
Complications / metallosis

Shedded metallic materal, leading to synovitis
“metallosis”



Complications / metallosis

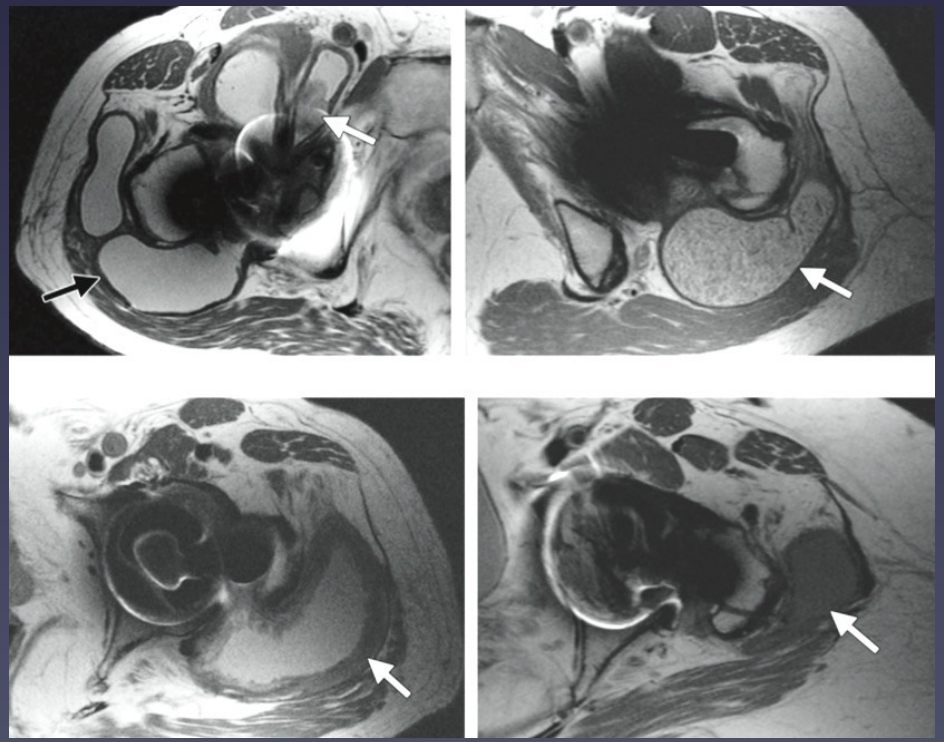
MRI signal void due to metal



Miscellaneous / ACL reconstruction

Interferenc
e screw
displaceme
nt

Complications / pseudotumor



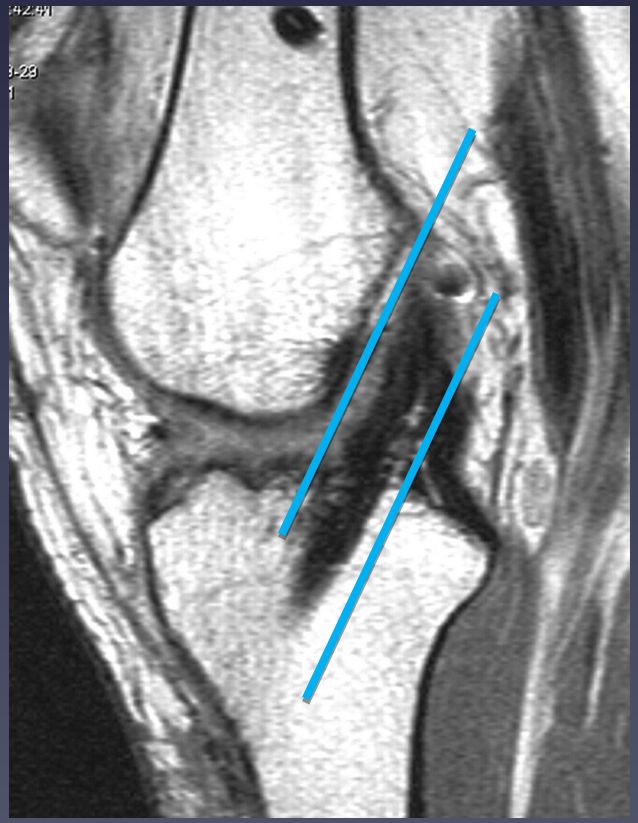
A complication of metal-on-metal hip implants

Cystic or solid, non-neoplastic, non-infectious inflammatory masses

Aka “adverse local tissue reaction” or “aseptic lymphocytic vasculitis-associated lesion (ALVAL)”

Miscellaneous / ACL reconstruction

Tunnels drilled so the graft axis is parallel to the roof of the intercondylar notch (Blumensaat's line)



Miscellaneous / ACL reconstruction

Roof impingement of the ACL graft due to the placement of the femoral/tibial tunnels

Miscellaneous / ACL reconstruction

Two different patients with displaced interferenc e screws

Miscellaneous / ACL reconstruction

Miscellaneous / ACL reconstruction

Arthrofibrosis
aka
“Cyclops lesion”

Miscellaneous / partial meniscectomy

Patient A: T1WI-FS arthrogram
S/P partial meniscectomy
New tear?

Patient B: T1WI arthrogram
S/P partial menisectomy
New tear?

Miscellaneous / partial meniscectomy

Normal postoperative appearance

Meniscal signal is not fluid-intensity

Meniscus re-tear

Fluid- or contrast-signal in meniscus

MSK / 2025

Orthopedic Hardware

Nomenclature and Complications for the Radiologist

Ryan Harvey, MD

February 7, 2025

RAF
Radiology Associates of Florida, P.A.
a radiology partners practice